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Workforce Development:

Basic and Intermediate Math for Industry

1.1 Lessons Abbreviation Key Table

C = Calculator Lesson
P = Pre-algebra Lesson
A = Algebra Lesson
G = Geometry Lesson
S = Special Topics

The number following the letter is the Lesson Number.

E = Exercises with Answers: Answers are in brackets **[ ]**.
EA = Exercises Answers: (only used when answers are not on the same page as the exercises.)
ES = Exercises Supplemental: Complete if you feel you need additional problems to work.

1.2 Exercises Introduction

Why do the Exercises?

Mathematics is like a "game." The more you practice and play the game the better you will understand and play it.

The Foundation's Exercises, which accompany each lesson, are designed to reinforce the ideas presented to you in that lesson's video.

It is unlikely you will learn math very well by simply reading about it or listening to Dr. Del, or anyone else, or watching someone else doing it.

You WILL learn math by "doing math."

It is like learning to play a musical instrument, or write a book, or play a sport, or play chess, or cooking.

You will learn by practice.

Repetition is the key to mastery.

You will make mistakes. You will sometimes struggle to master a concept or technique. You may feel frustration sometimes "**WE ALL DO**."

But, as you learn and do math, you will begin to find pleasure and enjoyment in it as you would in any worthwhile endeavor. Treat it like a sport or game.

These exercises are the KEY to your SUCCESS!

ENJOY!

TI-30Xa INTRODUCTION

The TI-30Xa Scientific Calculator is very good for Practical Mathematics. We have chosen this model for its ease of use and low cost. You may use another calculator, but be aware that they all have different key positions and work somewhat differently.

This series of lessons will explain the various basic functions and processes we will be using in the Fundamentals Course.

Each lesson will consist of a video explanation of the lesson's topic and homework to reinforce the lesson.

After you have mastered the topic you may take a quiz to prove your mastery of the topic. It is best to master each topic sequentially since later topics may depend on previous topics.

IMPORTANT: Mathematics is like a "contact sport." You must play and practice to master the necessary skills and knowledge.

Most people find mathematics like a game whereby knowledge and skills are acquired over time with practice and study.

Treat it like a game. Have fun! Do not be discouraged by mistakes or setbacks. That is part of the game.

Your learning will be cumulative. You will notice that things that seem difficult today will become easy tomorrow.

C1 LESSON: ON/OFF FIX DEG M1 M2 M3

TI-30Xa is the "Power Tool" we will be using.

Keys will be underlined. There are 40 Keys.

36 of these Keys have a dual function indicated in yellow above the key, and reached by the Yellow 2nd Key

On/C is the On and Clear Key: Upper Right

OFF is the Off Key: Row 1 Column 5

In the Display at top of calculator:

M1 M2 M3 are the memory indicators (top left - Lesson C5)

DEG is angle indicator (Lesson C12)

FIX indicates you have fixed the number of digits that appear after the decimal point. It is located above the decimal point at bottom.

Nine digits is the default when you turn on the calculator.

A good practice is to turn the calculator OFF between calculations. Numbers stored in Memory, M1, M2, M3 will not be lost.

Take the C1 Quiz when you are ready.

C1E

ON/OFF   FIX   DEG   M1 M2 M3

1. TI-30Xa is a P _ _ _ _ T _ _ _ of math?
2. The TI-30Xa has how many keys?
3. How many of these keys are dual function?
4. You activate a dual function with which key?
5. The ON/C key does what?
6. Where is the ON/C key?
7. Where is the OFF key?
8. How many Memory registers are there in the TI-30Xa?
9. Where is their indicator in the Display?
10. What does the DEG indicate in the display?
11. Where is the FIX function, and what does it do?
12. How do you display “n” digits after the decimal point?

Answers are on C1EA, page 9.

C1EA

ON/OFF FIX DEG M1 M2 Answers: [ ]'s

1. TI-30Xa is a P _ _ _ _ T _ _ _ of math? [**Power Tool**]

2. The TI-30Xa has how many keys? [**40**]

3. How many of these keys are dual function? [**36**]

4. You activate a dual function with which key?
   [**Yellow "2ND" Key in upper left corner.**]

5. The ON/C key does what?
   [**Turns TI-30Xa on and Clears the registers, and sets DEG. It does not change memory.**]

6. Where is the ON/C key? [**Upper Right Corner**]

7. Where is the OFF key? [**Below the ON/C Key**]

8. How many Memory registers are there in the TI-30Xa?
   [**Three, M1, M2, M3**]

9. Where is their indicator in the Display? [**Upper Left**]

10. What does the DEG indicate in the display?
    [**Angles will be entered in degrees**]

11. Where is the FIX function, and what does it do?
    [**Above the decimal point at bottom. It fixes the number of digits displayed after the decimal point.**]

12. How do you display n digits after the decimal point? [**2nd FIX n**]

C2 LESSON: REAL NUMBERS: ADD + SUBTRACT - EQUAL =

We assume you know basic arithmetic operations and rules. If not, you will need some more basic training.

Key k is indicated by **k** the underline.

The = Key is used to complete a calculation.

Addition + Key adds two numbers 3 + 4 = 7

Subtraction - Key subtracts numbers 7 - 2 = 5

Negative numbers will be discussed in Lesson 3

The TI-30Xa will take care of decimal locations.

12.3 + 7.5 = 19.8   12.3 + 7.05 = 19.35

Practice makes perfect!

The calculator is also a very good tool to help you learn the addition or multiplication tables.

And also, to help you learn to do approximate calculations which are a good idea to do a "quick check" for mistakes.

The more you "play" with it…the better you'll get!

C2E

ADD + SUBTRACT - EQUAL = Answers: [ ]'s

1. What key completes a calculation? [=]
2. Which key adds two numbers? [+]
3. Which key subtracts two numbers? [-]
4. 12.3 + 4.8 = ? [**17.1**]
5. 375 + 897 = ? [**1272**]
6. 0.075 + 0.0345 = ? [**0.1095**]
7. 87 - 39 = ? [**48**]
8. 12.34 - 7.05 = ? [**5.29**]
9. 0.0087 - 0.00032 = ? [**0.00838**]
10. 12 + 56 + 32 + 89 = ? [**189**]
11. 37 - 48 = ? [**-11**] (See C3 for Negative Numbers)
12. 3,879 + 7,425 = ? [**11,304**] (You supply commas)
13. 2.32 + 0.073 = ? [**2.39**]

Take the C2 Quiz if you are ready, or do some more exercises, C2ES.

C2ES

ADD + SUBTRACT - EQUAL = Answers: [ ]'s

1. 17.3 + 234.8 + 3.7 = ? [**255.8**]
2. 37.5 + 8.97 = ? [**46.47 or 46.5**]
3. 0.175 + 0.0385 = ? [**0.214**]
4. 97 - 19 = ? [**78**]
5. 12.74 - 9.05 = ? [**3.69**]
6. 0.087 - 0.032 = ? [**0.055**]
7. 12 + 96 + 52 + 29 = ? [**189**]
8. 57 - 98 = ? [**-41**]
9. 3,979 + 4,425 = ? [**8404**]
10. 28 - 12 - 17 = ? [**-1**]
11. 2.72 + 0.773 = ? [**3.493**]
12. 54321 - 12345 = ? [**41976**]
13. 9999 - 7654 = ? [**2345**]

Take the C2 Quiz or review.

C3 LESSON: NEGATIVE NUMBERS + ≈ -

For every positive number N there is a corresponding N negative number -N, and vice versa.

N + (-N) = 0 7 + (-7) = 0

- (-N) = N - (-6) = 6

You may create -N from N with the <u>+ ↔ -</u> Key located just left of the <u>=</u> Key

N <u>+ ↔ -</u> yields -N 17 <u>+ ↔ -</u> yields -17

-17 <u>+ ↔ -</u> yields 17

Subtraction is the same as adding a negative number.

N - M = N + (-M) 8 - 3 = 8 + (-3) = 5

-5 - 6 = -5 + (-6) = 5 <u>+ ↔ -</u> + 6 <u>+ ↔ -</u> = -11

-5 + -6 = -11

Play with this until you are comfortable with it. It's really easy once you catch on to it. Homework will really help here.

When you have mastered it, take the C3 Quiz.

C3E

NEGATIVE NUMBERS

Answers: [ ]'s

1. Where is the key that creates the negative of any number in the calculator's display? [**Bottom, Left of =**]

2. Create -7 in your calculator [**7 +=-**]

3. 8 + (-8) = ? [**0**]

4. 9 + (-4) = ? [**5**]

5. - (-5) = ? [**5**]

6. -7 + (-8) = ? [**-15**]

7. 18 - 11 = ? [**7**]

8. 18 + (-11) = ? [**7**]

9. 327 - 568 = ? [**-241**]

10. -13.7 + 8.5 = ? [**-5.2**]

11. -(-(- 7)) = ? [**-7**]

12. -3 + (-4) + (-5) = ? [**-12**]

**Take the C3 Quiz if you are ready,
or do some more exercises, C3ES.**

C3ES

NEGATIVE NUMBERS Answers: [ ]'s

1. -(-(-6)) = ? [**-6**]
2. Create -27 in your calculator [**27+=-**]
3. 18 + (-18) = ? [**0**]
4. 19 + (-8) = ? [**11**]
5. - (-8) = ? [**8**]
6. -9 + (-4) = ? [**-13**]
7. 18 - 61 = ? [**-43**]
8. 18 + (-61) = ? [**-43**]
9. 3827 - 968 = ? [**2859**]
10. -18.7 + 7.5 = ? [**-11.2**]
11. -(-(- 2.7)) = ? [**-2.7**]
12. -7 + (-4) + (-2) = ? [**-13**]

Take the C3 Quiz or review.

C4 LESSON: MULTIPLY x DIVIDE ÷

We assume you know basic arithmetic operations and rules.
If not, you will need some more basic training.

Key **k** is indicated by <u>**k**</u> the underline.

The **=** Key is used to complete a calculation.

Multiplication <u>**x**</u> Key multiplies two numbers

3 <u>**x**</u> 4 = 12 12.5 <u>**x**</u> 7.8 = 97.5

(3/8) <u>**x**</u> (5/6) = 5/16 (See Lesson 10 x on fractions.)

Rules:

(-A)**x**B = -(AxB) or (-A)B = -(AB)
(-A)x(-B) = AxB or (-A)(-B) = AB

Division <u>÷</u> Key Divides two numbers

A/B means A <u>÷</u> B

12/4 = 12 ÷ 4 = 3	15.7 ÷ 2.8 = 5.6
A/(-B) = -(A/B) = (-A)/B	18 ÷ -6 = -3
(-A)/(-B) = A/B	(-15)/(-5) = 3

Again, practice is the key to mastery.
Have fun with the exercises. Then take the C4 Quiz.

C4E

MULTIPLY x / DIVIDE ÷ Answers: [ ]'s

1. 3.5 x 7.4 = ? [**25.9**]
2. 154 x 896 = ? [**137,984**] (You put in the comma.)
3. 0.0075 x 0.02 = ? [**0.00015**]
4. -54 x 87 = ? [**-4698**]
5. (-32) x (-76) = ? [**2432**]
6. 79 ÷ 3 = [**26.3**]
7. 859 ÷ 54 = ? [**15.9**]
8. 86 ÷ (-3) = ? [**-28.7**]
9. (-45) ÷ (-2.5) = ? [**18.0**]
10. (87 x 34) ÷ 5 = ? [**591.6**]
11. (5.4 x 7.1)x2.3 = ? [**88.2**]
12. 8754 ÷ (-23) = ? [**-381**]
13. (54.2 ÷ 3.4) x (8.7 ÷ (-4.3)) = ? [**-32.3**]

Take the C4 Quiz or do some more exercises, C4ES.

C4ES

MULTIPLY x   DIVIDE ÷   Answers: [ ]'s

1. 3.8 x 9.4 = ?   [**35.7**]
2. 74 x 396 = ?   [**29304**]
3. 0.0035 x 0.08 = ?   [**0.00028**]
4. -59 x 27 = ?   [**-1593**]
5. (-36) x (-82) = ?   [**2952**]
6. 89 ÷ 4 = ?   [**22.25**]
7. 869 ÷ 34 = ?   [**25.6**]
8. 88 ÷ (-3) + ?   [**-29.3**]
9. (-47) ÷ (-6.5) = ?   [**7.2**]
10. [47 x 74] ÷ 6 = ?   [**580 or 579.67**]
11. (5.6 x 7.3) x 2.9 = ?   [**118.6**]
12. 8954 ÷ (-32) = ?   [**-280 or -279.8**]
13. (56.2 ÷ 3.2) x (9.7 ÷ (-2.3)) = ?   [**-74.1**]

Take the C4 Quiz or review.

C5 LESSON: PERCENTAGE %

We say X% (X Percent) of A is: (X/100)x A

30% of 100 is (30/100)x100 = .30 x 100 = 30

45% of 156 is (45/100)x156 = .45 x 156 = 70.2

There is a **%** Key on the TI-30Xa.

It is above the **2** Key. Select **2nd** then the number **2** to get it.

45 **2nd** **2** yields .45

So: 45 **2nd** **2** x 156 = 70.2

To add **X%** of A to A: A + **X** **2nd** **2** = (1 **+** X/100)A

Add 35% of 256 to itself: 256 + 35 **2nd** **2** = 345.6

There will be a deeper Lesson on Percentages, Discounts and Mark-ups in Tier 3 which goes into more detail on percentages.

This is just to show you how the % Key works.

C5E

PERCENTAGE % Answers: [ ]'s

1. Where is the % key on the TI-30Xa? [**Above the 2**]
2. How do you activate the % Function? [**Press the yellow <u>2nd</u> Then the <u>2</u> key.**
3. What is 45% of 156? [**70.2**]
4. Enter 45 Display is ? [**45**]
   Press **2nd 2** Key Display is ? [**0.45**]
   Press the **x** Key Display is ? [**0.45**]
   Enter 156 Display is ? [**156**]
   Press **=** Key Display is ? [**70.2**]
5. What is 87% of 835? [**726.45**]
6. Add 35% or 287 to itself. [**387.45**]
7. Enter 287 Display is ? [**287**]
   Press **+** Key Display is ? [**287**]
   Enter 35 Display is ? [**35**]
   Press **2nd 2** Key Display is ? [**100.45**]
   Press **=** Key Display is ? [**387.45**]
8. 165% of 200 is? [**330**]
9. Add 80% of 125 to itself and get? [**225**]
10. 4% of 1000 is? [**40**]

Take the C5 Quiz if ready,
or do more exercises, C5ES.

C5ES

PERCENTAGE % Answers: [ ]'s

1. What is 145% of 156? [**226.2**]

2. Enter 145 Display is ? [**145**]
   Press **2nd 2** Key Display is ? [**1.45**]
   Press the **x** Key Display is ? [**1.45**]
   Enter 156 Display is ? [**156**]
   Press **=** Key Display is ? [**226.2**]

3. Enter 156 Display is ? [156]
   Press **x** Key Display is ? [156]
   Enter 145 Display is ? [145]
   Press **2nd 2** Key Display is ? [1.45]
   Press **=** Key Display is ? [226.2]

Do you see the two different ways?

4. What is 37**%** of 835? [**309**]

5. What is 137**%** of 835 [**1144 = 835 + 309**]

6. Add 55**%** of 287 to itself. [**444.85**]

7. Enter 287 Display is ? [**287**]
   Press **+** Key Display is ? [**287**]
   Enter 55% Display is ? [**55**]
   Press **2nd 2** Key Display is ? [**157.85**]
   Press **=** Key Display is ? [**444.85**]

Make up some problems for yourself and take the C5 Quiz.

C6 LESSON: MEMORY M1, M2, M3 STO RCL ( )

Sometimes you may need to store a number in the calculator to be recalled later.

STO and RCL do this.

There are three memory registers, **M1**, **M2**, and **M3**.

To store a number N in memory register 1 do this:

Enter N, then STO 1 and **N** is stored in **M1**

Later to recall N: RCL 1 will restore N.

Example: (3 x 4) + (5 x 7) + (4 x 8)

3 x 4 = 12 STO 1, 5 x 7 = 35 STO 2, 4 x 8 = 32

Now 32 + RCL **1** + RCL 2 **=** 79

Or use the **( )** keys: Simply duplicate the above.

Memory is used when you need to store a number for later use. Parenthesis are used for shorter term storage in a calculation.

For example, if you need to store someone's phone number; say, 5013452314, simply enter this and STO 1.

Now RCL 1 will recall it anytime in the future even if you turn the calculator OFF. Only storing another number in **M1** will erase it.

C6E

MEMORY M1, M2, M3 STO RCL ( )

1. How many memory registers does the TI-30Xa have?
2. Where do you see the **M1, M2,** and **M3** displayed?
3. Which keys do you use to store a number in memory **M2**?
4. Store 235 in **M2**.
5. How do you recall the number in stored in **M2**?
6. What number is in **M2**?
7. Do you lose the numbers stored in memory when you turn the calculator off?
8. How do you "clear" the memory register **M3**?
9. What can you also use for temporary memory storage when doing a calculation?
10. (12.3 + 87) x (34 + 56) = ?

Answers are on C6EA, page 24.

"Play" with the memory and ( ) until you are comfortable with them…then take the C6 Quiz.

C6EA

MEMORY M1, M2, M3 STO RCL ( ) Answers: [ ]'s

1. How many memory registers does the TI-30Xa have? [**3**]

2. Where are the **M1**, **M2** and **M3** displayed? [**Upper Left**]

3. Which keys do you use to store a number in memory **M2**? [**STO 2**]

4. Store 235 in **M2**. [**Enter 235 press STO 2**]

5. How do you recall the number in stored in **M2**? [**RCL 2**]

6. What number is in **M2**? [**235**]

7. Do you lose the numbers stored in Memory when you turn the calculator off? [**No**]

8. How do you "clear" the memory register M3? [**Enter 0 Press STO 3**]

9. What can you also use for temporary memory storage when doing a calculation? [**( )**]

10. (12.3 + 87) **x** (34 + 56) = ? [**8937**]

"Play" with the memory and ( ) until you are comfortable with them…then take the C6 Quiz.

C7 LESSON: X^2 SQUARE

Definition: **A^2** = AxA…we say: **A squared**

$5^2 = 5x5 = 25$ $(7.4)^2 = 7.4x7.4 = 54.8$

An easier way to get this is the **$\underline{x}^2$** key

7.4x2 yields 54.8 (or 54.76 depending on the **FIX.**)

This is handy for larger numbers.

543.7 squared is simply 543.7 **$\underline{x}^2$** = 295609.69

You must supply the commas: 295,609.69

Very quick and easy and used a lot in practical math.

NOTE: $(-A)^2 = A^2$ -5 **$\underline{x}^2$** = 25 So **$\underline{x}^2$** result is always positive.

As usual, exercises and C7 Quiz.

C7E

X^2 SQUARE   Answers: [ ]'s

1. What is the definition of A^2? [**AxA**]
2. Where is the x^2 key on the TI-30Xa? [**3 down middle**]
3. $(137.4)^2 = ?$ [**18878.76 or 18,878.76**]
4. $(6.2)^2 = ?$ [**38.44**]
5. $(-8.7)^2 = ?$ [**75.69**]
6. $(3.4 + 8.7)^2 = ?$ [**146.41**]
7. $(5^2)^2 = ?$ [**625**]
8. $(78 \div 3.3)^2 = ?$ [**558.7**]
9. Can A^2 be negative? [**No**]
10. $7^2 - 3^2 = ?$ [**40**]
11. $(((((2)^2)^2)^2)^2)^2 = ?$ [**4,294,967,296**]

Play with x^2 Key until you have mastered it.

Take the C7 Quiz or practice some more with C7ES.

C7ES

X^2 SQUARE Answers: [ ]'s

1. $(92.56)^2 = ?$ [8567.35]
2. $(16.2)^2 = ?$ [262.4]
3. $(-75.7)^2 = ?$ [5730.5]
4. $(4.3 + 6.7)^2 = ?$ [121]
5. $(7^2)^2 = ?$ [2401]
6. $(478 \div 23.3)^2 = ?$ [420.9]
7. Can A^2 be 0? [Yes, $0^2 = 0$]
8. $8^2 - 12^2 = ?$ [-80]
9. $(((((2.05)^2)^2)^2)^2)^2 = ?$ [9,465,063,976]

   Compare to #11 on previous page!

10. $(2\ 3/4)^2 = ?$ [7 9/16 = 121/16 = 7.5625]

Play with x^2 key until you have mastered it.
Take the C7 Quiz or review.

C8 LESSON: √X SQUARE ROOT

Definition: $(\sqrt{A})^2 = A$

$\sqrt{25} = 5$ since 52 = 25

The "problem" is given A, what is √A?

In the old days, this was a difficult problem and there was not an easy way to determine it. But, today thanks to the power tool of math, the calculator, it is very easy.

Just use the **√x** key.

346 **√x** yields the answer 18.6

Also, note **x^2** and **√x** are "**inverses.**"

This was revolutionary in the 1970's. It changed many ways we taught engineering and science subjects along with the trig functions.

NOTE: You may not take the square root of a negative number with this calculator. The square root of a negative number exists, but it is not a real number. It is called a complex or imaginary number and will require a more sophisticated power tool. See Tier 4.

For now, **-**7 **√x** yields an “Error” message.

As usual, Exercises and the C8 Quiz.

C8E

$\sqrt{X}$ SQUARE ROOT Answers: [ ]'s

1. Define $\sqrt{A}$ [$(\sqrt{A})^2 = A$]
2. $\sqrt{36} = ?$ [6]
3. $\sqrt{137} = ?$ [11.7]
4. $\sqrt{19.4} = ?$ [4.4]
5. $\sqrt{(5.4 + 87.2)} = ?$ [9.6]
6. $(\sqrt{76})^2 = ?$ [76]
7. $\sqrt{(35)^2} = ?$ [35]
8. $\sqrt{-73} = ?$ [Error] Why?
9. $\sqrt{(\sqrt{98})} = ?$ [3.15]
10. $\sqrt{98765432} = ?$ [9938]

Play with √ until you are comfortable with it.

Take the C8 Quiz or do some more exercises, C8ES.

C8ES

√X SQUARE ROOT — Answers: [ ]'s

1. Define √A	[**√A x √A = A**]
2. √256 = ?	[**16**]
3. √1,000,000 = ?	[**1,000**]
4. √1000 = ?	[**31.6**]
5. √1024 = ?	[**32**]
6. $(\sqrt{1776})^2$ = ?	[**1776**]
7. √(√(√(√(√4,294,967,296)))) = ?	[**2**]
8. √-(-81) = ?	[**9**]
9. √(√81) = ?	[**3**]
10. √987654321 = ?	[**31427 ~ 10, 000π**]

Play with √ until you are comfortable with it.

Take the C8 Quiz or review.

C9 LESSON: 1/X RECIPROCAL "FLIP IT"

1 ÷ x is called the "reciprocal." Thus, 1/5 = .2.

Now the 1/x Key makes calculating it easy.

5 1/x yields .2

7 1/x yields .142857143 or .143 or .14 (**FIX**)

NOTE: **1/x** is its own inverse; N **1/x 1/x** yields N…You try it!

To recap our progress so far:

+ - x ÷ x^2 √x 1/x = are the eight "**work horse**" keys of practical math.

Learn them well. They are your friends.

The **( )** and **RCL** and **STO** will help sometimes.

So far, we have dealt only with real numbers expressed as base ten decimal numbers. This is often all you will ever need. But; sometimes, we express numbers as fractions. There are some wonderful keys that will help here too. (**See C10, C11, and C12**)

C9E

1/X RECIPROCAL "FLIP IT" Answers: [ ]’s

1. Define 1/x [1 ÷ x]
2. 1/89 = ? [0.011]
3. 1 ÷ 89 = ? [0.011]
4. The reciprocal of 3 is ? [1/3 = 0.33]
5. 1/1/79 = ? [79]
6. 1/1/S = ? [S]
7. 1/0.7 = ? [1.429]
8. 1/0.07 = ? [14.29]
9. 1/0.007 = ? [142.9]
10. $1/(3^2 + 4^2)$ = ? [0.04 or 1/25]
11. √[1/25] = ? [0.2]
12. $(1/25)^2$ = ? [0.0016]

Play with 1/x

Take the C9 Quiz or do more exercises, C9ES.

C9ES

1/X RECIPROCAL "FLIP IT" Answers: [ ]'s

1. 1/0 = ?	[**Error**]
2. 1/1 = ?	[**1**]
3. 1/0.5 = ?	[**2**]
4. 1/(1/2) = ?	[**2**]
5. 1/1/9 = ?	[**9**]
6. 1/1/A = ?	[**A**]
7. 1/(3 + 4) = ?	[**0.14**]
8. 1/√16 = ?	[**0.25**]
9. 1/(1 + 2 + 3) = ?	[**1/6 = 0.166667**]
10. 1/1/1/1/1/3 = ?	[**0.3333**]
11. 1/1/1/1/1/1/3 = ?	[**3**]
12. $(1/7)^2$ = ?	[**0.02**]

Play with 1/x
Take the C9 Quiz or review.

C10 LESSON: FRACTIONS $A^{B/C}$ + - X ÷ 1/X

Let's quickly review fractions. Let A and B be two **integers**. Then, A/B is called a **fraction**. If A > B then this fraction is greater than 1 and called **improper**. There are four rules for adding, subtracting, multiplying and dividing fractions you should know.

A/B + C/D = (AD +BC)/BD
A/B - C/D = (AD -BC)/BD
A/BxC/D = AC/BD
(A/B)/(C/D) = A/BxD/C

2/3 + 4/5 = (2x5 + 3x4)/3x5 = (10+12)/15 =
22/15 = 1 7/15

The $a^{b/c}$ lets you enter the two fractions and add them. Watch the video to see how.

Similarly you can subtract, multiply, and divide two fractions. See the video. **Do the exercises**.

The largest denominator you may enter is 999. So, if you should multiply two fractions resulting in a denominator greater than 999, the answer will be in decimal form.

Also, you may apply the other function keys to fractions just like any other number.

C10E

FRACTIONS $a^{b/c}$ + - X ÷ 1/X   Answers: [ ]'s

1. 3/4 + 7/8 = ?   [1 5/8 = 13/8 = 1.625]
2. 7/8 - 2/3 = ?   [5/24]
3. 2/3x4/5 = ?   [8/15]
4. 5/6 ÷ 2/3 = ?   [1 1/4 = 5/4 = 1.25]
5. -5/6 x 2/3 = ?   [-5/9]
6. -3/4 x -2/3 = ?   [1/2]
7. 1/(2/3) = ?   [1.5 = 1 1/2 = 3/2]
8. $(6/7)^2$ = ?   [0.734693878 = 36/49]
9. √(5/6) = ?   [0.91287]
10. What is largest denominator you can enter for a fraction with the TI-30Xa?   [999]
11. 17/8 + 13/3 = ?   [6 11/24 = 155/24 = 6.46]
12. 5/6 ÷ 7/9 = ?   [1 1/14 = 15/14 = 1.07]

Play with fractions.

Take the C10 Quiz or do more exercises, C10ES.

C10ES

FRACTIONS $a^{b/c}$ + - X ÷ 1/X Answers: [ ]'s

1. 3/7 + 7/8 = ? [**1** 17/56 **= 73/56 = 1.30**]

2. 7/8 - 5/6 = ? [**1/24**]

3. 2/3 x 2/5 = ? [**4/15**]

4. 5/9 ÷ 2/3 = ? [**5/6**]

5. -5/6 x 4/3 = ? [**-1** 1/9 **= -10/9 = -1.11**]

6. -5/4 x -2/3 = ? [**5/6**]

7. 1/(2/7) = ? [**3.5 = 3** 1/2 **= 7/2**]

8. $(5/7)^2$ = ? [**25/49 = 0.51**]

9. √(4/7) = ? [**0.756**]

10. What is largest denominator you can enter for a fraction with the TI-30Xa? [**999**]

11. 1 7/8 + 2 3/4 = ? [**4** 5/8]

12. 5/8 ÷ 7/12 = ? [**1.07 = 15/14 = 11/14**]

Play with fractions.

C11 LESSON: D/C PROPER / IMPROPER FRACTION

"**d/c**" is a yellow "key" seen above the **a$^{b/c}$ key.** You get to it by selecting **2nd** **a$^{b/c}$**.

If A < B, A/B is called a proper fraction. (6/8)

If A > B, A/B is called an improper fraction. (8/6)

A Mixed Fraction is an integer plus a fraction like 2 3/4.

If A and B share no common factor we say A/B is reduced to lowest terms. 6/8 = 3/4 in lowest terms.

The d/c Key does this plus more. It is **2nd** **a$^{b/c}$**.

Enter 2 3/6 as a mixed fraction (watch video) .

Hit the d/c Key and get 15/6…**again**…2 1/2…**again**…5/2.

So you first get an improper, then mixed lowest terms and then improper lowest.

Play with it. Do some exercises. Have fun.

Remember…largest denominator is 999, otherwise it will convert automatically to decimal. (See next Lesson, C12.)

C11E

D/C PROPER/IMPROPER FRACTION   Answers: [ ]'s

1. Where is the "d/c" Key or Function? [2nd ab/c]
   Express the answer as an improper fraction and a mixed fraction.
2. 3/4 + 4/5 = ? [**31/20 = 1 11/20**]
3. 2/3 ÷ 4/7 = ? [**7/6 = 1 1/6**]
4. 1 2/3 + 3 3/4 = ? [**65/12 = 5 5/12**]
5. 6 7/8 – 2 2/3 = ? [**101/24 = 4 5/24**]
6. $(2\ 3/4)^2$ = ? [**121/16 = 7 9/16 = 7.5625**]
7. -(6/7) x 13/8 [**-39/28 = -1 11/28**]
8. 2 x 4 3/4 = ? [**19/2 = 9 1/2**]
9. 15/7 + 2 3/4 + 12/5 = ? [**1021/140 = 7 41/140**]
10. 2 3/4 ÷ 15/7 = ? [**77/60 = 1 17/60**]
11. √(7/4 - 5/13) = ? [**1.17**]
12. $\sqrt{(3^2 + 4^2)}$ = ? [**5**]

NOTE: In Question 6, the answer is 7.5625. In Lesson 12, you will learn how to convert 79/16 to a decimal.

Take the C11 Quiz or do more exercises, C11ES

C11ES

D/C PROPER/IMPROPER FRACTION Answers: [ ]'s

1. Where is the "F <--> D" Key or Function?

   [**2nd <-----**] [**Lower Left Corner**]

   Express the answer as an improper fraction and a mixed fraction.

2. 3/7 + 17/21 = ? [**1 5/21 = 26/21**]

3. 2/3 ÷ 2/7 = ? [**2 1/3 = 7/3**]

4. 2 2/3 + 5 3/4 = ? [**8 5/12 = 101/12**]

5. 4 7/8 – 2 2/5 = ? [**2 19/40 = 99/40**]

6. $(2\ 3/5)^2$ = ? [**6 19/25 = 169/25 = 6.76**]

7. -(6/7) x 1 3/8 [**-1 5/28 = -33/28**]

8. 3.5 x 3 3/5 = ? [**12 3/5 = 63/5**]

9. 1 5/7 + 2 3/4 + 12/5 = ? [**6 121/140 = 961/140**]

10. 3 3/4 ÷ 13/7 = ? [**2 1/52 = 105/52**]

11. √(17/5 - 2/13) = ? [**1.8**]

12. $\sqrt{}$ {$(1/3)^2$ + $(1/4)^2$)} = ? [**0.417 = 5/12**]

NOTE: In Question 6, the answer is 6.76. In Lesson 12, you will learn how to convert 169/25 to a decimal.

Take the C11 Quiz or review.

C12 LESSON: F ↔ D FRACTION TO DECIMAL CONVERSION

Any fraction can be converted to a decimal, although sometimes it will only be an approximation.

1/2 = .5 exactly, 1/3 = .3333 approximately.

This can be accomplished automatically with the **F ↔ D** yellow "Key" via **2nd** ← .

2/3 **F ↔ D** .66667 depending on the **FIX**.

F ↔ D again and you get 2/3 back.

Warning. If you enter .66667 and then **F ↔ D**, nothing will happen…no fraction. **F ↔ D** only works when you **start** with a fraction.

So, it is convenient when you want to end up with a decimal.

Ex: 8/15 + 9/17 = 116/255… you want the decimal equivalent.

Just **F ↔ D** and get 1.06275 (depending on **FIX**)

Also, you can go back, and then use **d/c** to get 271/255.

Again, **have fun** with some exercises and it will soon be very easy to use these three keys. Even if you can "do" fractions manually, this will be much faster and more error free. That's the point of a "power tool."

C12E

F ↔ D   FRACTION TO DECIMAL CONVERSION
Answers: [ ]’s

1. Where is the **F ↔ D** "Key" or Function?
   [**2nd ← Bottom Left of Keypad**]

2. Convert 3/7 to decimal [**0.4286**]

3. Convert 0.375 to fraction [**3/8**]

4. Convert 1/3 to decimal [**0.33333333**]

5. Convert 0.33 to fraction [33/100]

6. Convert 0.333 to fraction [**0.333**]

7. What Happened? Why not 1/3?
   [**Denominator would be 1000, larger than 999**]

8. What is largest denominator you can enter? [**999**]

9. Can you get 3/250 + 4/7 in fraction form?
   [**No, not with the TI-30Xa.**
   (3x7 + 4x250)/1750 = 1021/1750 = 0.5834]

10. Convert 568/126 to improper fraction in lowest terms.
    [**284/63**]

Take C12 Quiz or do some more exercises, C12ES.

C12ES

F ↔ D FRACTION TO DECIMAL CONVERSION

Answers: [ ]'s

1. Convert 7/3 to decimal [**2.33**]
2. Convert 3/8 to decimal [**0.375**]
3. Convert 0.385 to fraction [**77/200**]
4. Convert 2 1/3 to decimal [**2.333**]
5. Convert 3 1/7 to decimal [**3.1428**]
6. Convert 0.044 to fraction [**11/250**]
7. Convert 0.0444 to fraction [**0.0444**]
8. What Happened? [**Too large a denominator**]
9. What is largest denominator for the TI-30Xa? [**999**]
10. Can you get 3/250 + 4/7 in fraction form? [**No**]
11. Convert 476/252 to improper fraction in lowest terms. [**17/9**]

Take the C12 Quiz or review.

PRE-ALGEBRA INTRODUCTION

In this Foundation course we will be dealing with what are commonly called "Real Numbers" which consist of:

Integers or Whole Numbers, both positive and negative.

Fractions, or quotients, or ratios of integers.

We will usually express numbers in the standard decimal format such as:

327.45 = 3x100 + 2x10 + 7 + .4 + .05 where

.4 = 3/10 and .5 = 5/100

The Real Numbers correspond to points on a straight line.

There are four basic arithmetic operations: + - x ÷ and a few higher level operations such as: x^2 1/x √x

There are several "Rules" or "Laws" of arithmetic.

We assume you already know most of this and will review it briefly in the following Pre-algebra lessons. See the Table of Contents for a listing of the lessons.

We will use the TI-30Xa calculator for most of the calculations we perform in this Foundations Course since it accelerates the learning and application of what you will be learning significantly.

The Keys to perform these operations have been discussed in the Lessons on the use of the TI-30Xa calculator.

P1 LESSON: REAL NUMBERS, INTEGERS AND RATIONALS

First, there are the "counting numbers," 1, 2, 3, 4…also called Natural Numbers and Positive Integers.

We count with the usual decimal system which you should know.

Then we have the number Zero (0) which signifies the absence of something.

Then there are the "negative integers." These are just like the integers; but, have a - sign in front of them, e.g., -5, -6 . . .

Then there are the "fractions" or "rational" numbers which are the ratios or quotients of integers, 3/4, -7/8, 15/7, etc.

We will usually express numbers in the standard decimal format such as:

$$327.45 = 3x100 + 2x10 + 7 + .4 + .05 \text{ where}$$

$$.4 = 4/10 \text{ and } .05 = 5/100$$

It is sometimes easiest to understand these numbers when they are corresponded to points on a straight line, see the next lesson P2.

Later we will review the various operations and "rules" of arithmetic.

Always use the calculator to help yourself understand the various things we are discussing.

We assume this is essentially a review for things you already have learned.

P1E

ARITHMETIC REVIEW

1. What kind of numbers will we deal with in the Foundation Course?

2. What are Integers?

3. What are Rational Numbers?

4. What number is 3x100 + 2x10 + 7 + 0.4 + 0.05?

5. What do the Real Numbers correspond to?

6. What are the four basic operations?

7. What calculator will we use in the Foundation Course?

8. What other three subjects will we learn about in the Foundations Course after Pre-Algebra?

Answers on P1EA, page 8.

Take the Quiz

ARITHMETIC REVIEW Answers: [ ]'s

1. What kind of numbers will we deal with in the Foundation Course? [**Real Numbers**]

2. What are Integers? [**Whole or counting numbers both positive and negative**]

3. What are Rational Numbers? [**Fractions, a/b where a and b are integers, b ≠ 0**]

4. What number is 3x100 + 2x10 + 7 + 0.4 + 0.05? [**327.45**]

5. What do the Real Numbers correspond to? [**Points on a straight line**]

6. What are the four basic operations? **[+, -, x, ÷]**

7. What calculator will we use in the Foundation Course?

   [**TI-30Xa**]

8. What other three subjects will we learn about in the Foundations Course after Pre-Algebra?

   [**Algebra, Geometry, Trigonometry**]

P2 LESSON: THE NUMBER LINE, NEGATIVE NUMBERS

The Real Numbers we will be using in this Foundation Course can be corresponded to the points on a straight line called the Number Line.

We select a point to call Zero, 0.

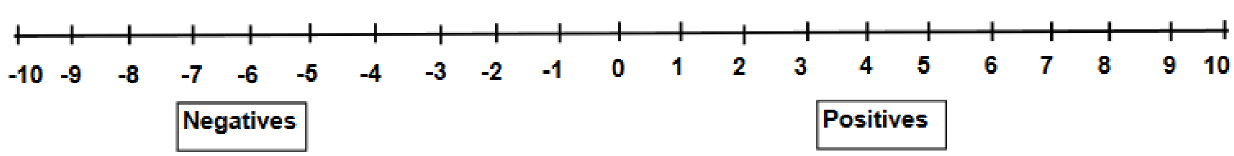
We then select a point to the right of 0 and label it 1.

This establishes a "scale" and all numbers now correspond to one unique point on the line. (See below)

Positive numbers are to the right of 0, and Negative numbers are to the left of 0. The Negatives are a sort of "mirror" image of the Positives.

> $a < b$ means a is to the left of b on the number line.
> $a > b$ means a is to the right of b on the number line.
> $a = b$ means a and b correspond to the same point.

You should be able to find the appropriate point on the line for any number, and vice versa.

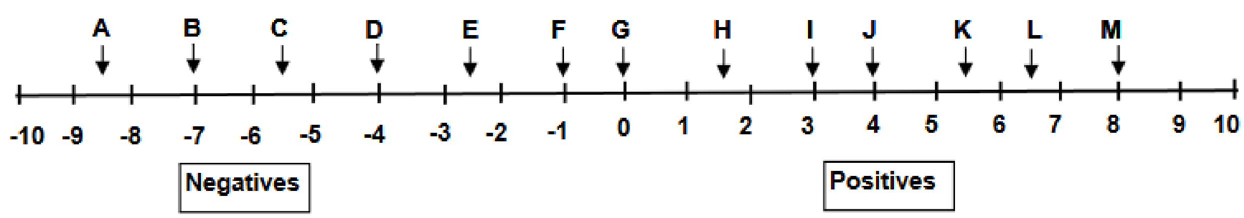


P2E

THE NUMBER LINE, NEGATIVE NUMBERS

Answers: [ ]'s

1. Which letter is above 5.5? [**K**]
2. Which letter is above 3? [**I**]
3. Which letter is above -7? [**B**]
4. Which letter is above -2.5? [**E**]
5. What number is C above? [**-5.5**]
6. What number is L above? [**6.5**]
7. What number is G above? [**0**]
8. Is -3 > -6? [**Yes**]
9. Is -3 < 1? [**Yes**]
10. Is -6 > 0? [**No**]



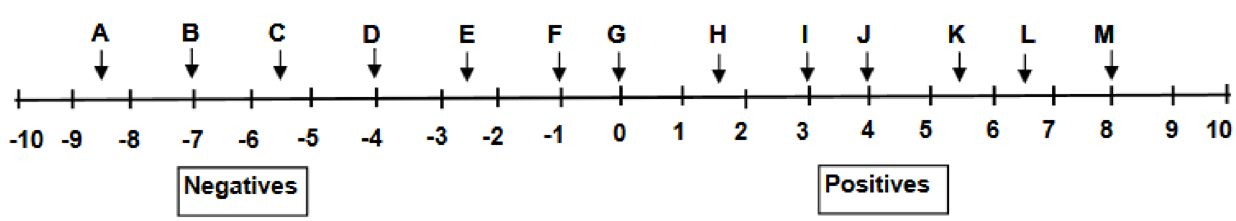
Problem: Given a number, find its location on the number line.
Problem: Give a point on the number line, estimate its value.

P2ES

THE NUMBER LINE, NEGATIVE NUMBERS

Answers: [ ]'s

1. Which letter is above -4? [**D**]
2. Which letter is above 1.6? [**H**]
3. Which letter is above -5.5? [**C**]
4. Which letter is above 6.5? [**L**]
5. What number is E above? [**-2.5**]
6. What number is K above? [**5.5**]
7. What number is C above? [**-5.5**]
8. Is -1 > -3? [**Yes**]
9. Is -3 < -1? [**Yes**]
10. Is -6 > -7? [**Yes**]



Problem: Given a number, find its location on the number line.
Problem: Give a point on the number line, estimate its value.

P3 LESSON: RULES OF ADDITION + -

Rules of Addition: a, b, c represent an arbitrary real numbers

1. $a + 0 = a$ $\quad$ $7 + 0 = 7$

2. $a + b = b + a$ $\quad$ $15 + 6 = 6 + 15 = 21$

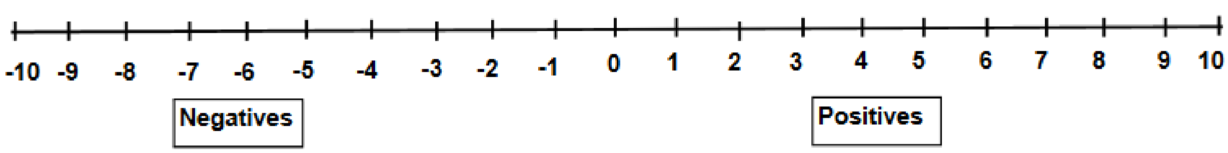
3. $(a + b) + c = a + (b + c)$ $\quad$ $(4 + 7) + 5 = 4 + (7 + 5) = 16$

4. $-(-a) = +a = a$ $\quad$ $-(-8) = 8$

5. $b - a = b + (-a)$ $\quad$ $7 - 3 = 7 + (-3) = 4$ $\quad$ $4 - 9 = 4 + (-9) = -5$

6. $a - a = a + (-a) = 0$ $\quad$ $8 - 8 = 0 = 8 + (-8)$

Note how addition works on the Number Line. Watch the video lesson that accompanies this lesson.



Problem: Given two numbers, find their sum's location on the number line.

Problem: Given two numbers, find their difference's location on the number line.

P3E

RULES OF ADDITION + - Answers: [ ]'s

1. 3 + 9 = ? [**12**]

2. 126 + 879 + 438 = ? [**1443**]

3. 15.4 + 85.9 + 34.7 = ? [**136.0**]

4. 56.4 - 87.2 = ? [**-30.8**]

5. 0.078 + 0.048 = ? [**0.126**]

6. 87 - 341 = ? [**-254**]

7. 98 - (-34) = ? [**132**]

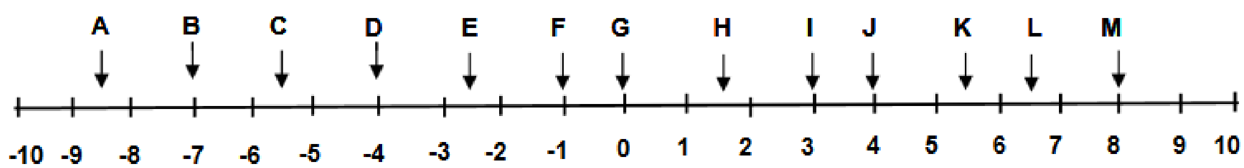
8. Where is D + I on the number line? [**F**]

9. Where is K - H on the number line? [**J**]

10. -17.2 - 34.8 + 12.5 = ? [**-39.5**]

11. 245,400 + 782,900 = ? [**1,028,300**]

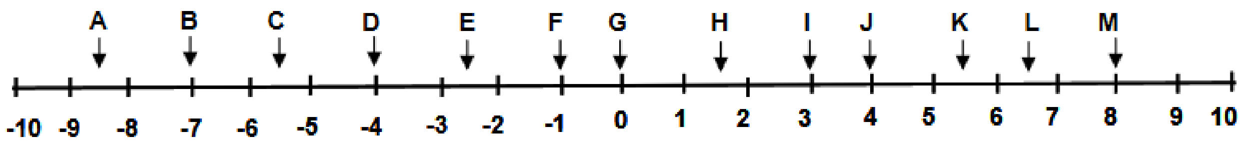
12. -(-34) -(-23) = ? [**57**]



P3ES

RULES OF ADDITION +, - Answers: [ ]'s

1. 13 +29 = ? [**42**]
2. 176 + 839 +538 = ? [**1553**]
3. 17.4 + 35.3 + 34.9 = ? [**87.6**]
4. 57.4 - 89.2 = ? [**-31.8**]
5. 0.068 + 0.036 = ? [**0.104**]
6. 83 - 345 = ? [**-262**]
7. 92 - (-34) = ? [**126**]
8. Where is J + F on the number line? [**I**]
9. Where is K - F on the number line? [**L**]
10. Where is 7.7 - 2.2 on the number line? [**K**]
11. -(-37) + (-23) = ? [**14**]
12. -(-37) -(-23) = ? [**60**]



Take Quiz or review

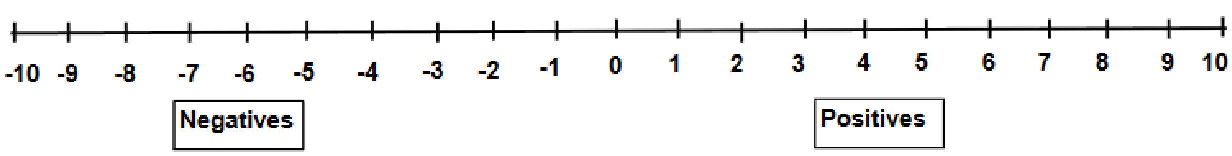
P4 LESSON: RULES OF MULTIPLICATION X ÷

Multiplication of Real Numbers axb or ab or a·b

a, b, c represents arbitrary real numbers

1. a x 0 = 0	7 x 0 = 0
2. a x 1 = a	13 x 1 = 13
3. a x b = b x a [ab = bc]	15 x 6 = 6 x 15 = 90
4. (ab)c = a(bc)	(4 x 7) x 5 = 4 x (7x 5) = 140
5. (-a)xb = -(axb)	(-13) x 12 = -156
6. (-a)x(-b) = axb	-5x(-6) = 30
7. ax(1/a) = 1 (a ≠ 0)	7x(1/7) = 1
8. a ÷ b = ax(1/b) (b ≠ 0)	12 ÷ 4 = 3 = 12x(1/4)

Note how Multiplication works on the Number Line. Watch the Video lesson that accompanies this lesson.



Problem: Given two numbers, find their product's location on the number line.

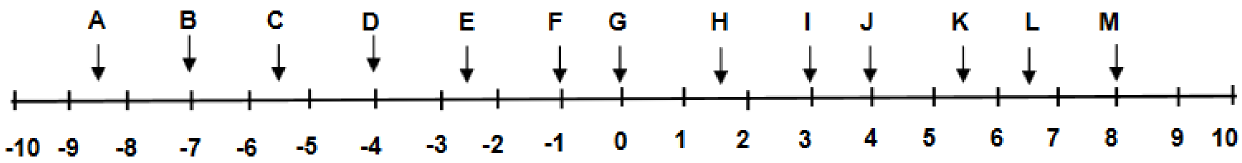
Problem: Given a number, find its reciprocal location on the number line.

P4E

RULES OF MULTIPLICATION X ÷ Answers: [ ]'s

Multiplication of Real Numbers axb or ab or a·b

1. 4 x 5 = ? [**20**]
2. 12.4 x 13.8 = ? [**171.1**]
3. 739 x 546 = ? [**403,494**]
4. 3.2 x 7.8 x 5.4 = ? [**134.8**]
5. -34 x 27 = ? [**-918**]
6. 0.0034 x 0.056 = ? [**0.00019**]
7. -87 x (-23) = ? [**2001**]
8. Where is J x F on the number line? [**D**]
9. 43.5 ÷ 6.9 = ? [**6.3**]
10. 198 ÷ 5,748 = ? [**0.034**]
11. 78 ÷ (-.03) = ? [**-2600**]
12. -45 ÷ -2.3 = ? [**19.6**]



Take the Quiz or do more exercises on P4ES

P4ES

RULES OF MULTIPLICATION X ÷ Answers: [ ]'s

Multiplication of Real Numbers axb or ab or a·b

1. 0.4 x 0.5 = ? [**0.2**]

2. 17.4 x 54.8 = ? [**953.5**]

3. -0.4 x 0.5 = ? [**-0.2**]

4. 3.4 x 7.8 x 5.7 = ? [**151.2**]

5. -0.4 x (-0.5) = ? [**0.2**]

6. 0.0037 x 0.046 = ? [**0.00017**]

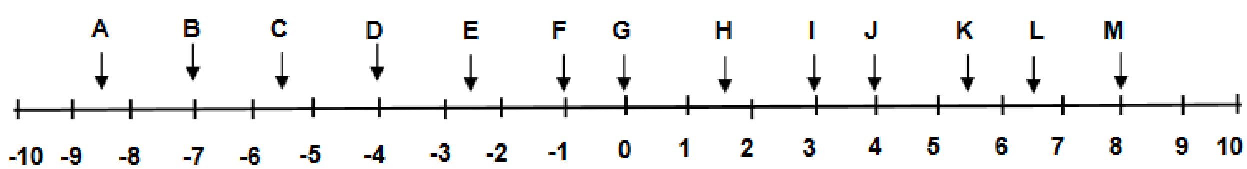
7. 2 2/3 x 1 1/4 = ? [**3 1/3 = 10/3 = 3.3**]

8. Where is -0.5 x 8 on the number line? [**D**]

9. 4 3/5 ÷ 2 3/5 = ? [**1 10/13 = 23/13 = 1.77**]

10. 0.198 ÷ 0.058 = ? [**3.41**]

11. 78 ÷ (-0.3) = ? [**-260**]



Take Quiz or review

P5 LESSON: DISTRIBUTIVE LAW + AND X COMBINED

Distributive Law and Factoring Real Numbers

a, b, c represents arbitrary real numbers

1. ax(b + c) = axb + axc   or a(b +c) = ab + ac   Simplifying

2. axb + axc = ax(b +c) or ab + ac = a(b + c)   Factoring

x, y, z represent arbitrary numbers

3. (x + y)z = xz + yz   Simplifying

4. xz + yz = (x + y)z = z(x + y)   Factoring

Note how the Distributive Law works on the Number Line. Watch the Video lesson that accompanies this lesson.

P5E

DISTRIBUTIVE LAW + AND X COMBINED

Answers: [ ]'s

Distributive Law and Factoring Real Numbers

1. 12x(34 + 23) = ? [**684**]
2. (2.5 - 3.7)x6.9 = ? [**-8.3**]
3. (78.9 + 43.7)x(34.1 + 13.4) = ? [**5823.5**]
4. 45x67 + 45x82 = 45x(?) [**67 + 82 = 149**]
5. 576x4 - 576x3 = ? [**576x(4-3) = 576**]
6. ab + ad = ax(?) **[(b + d)]**
7. tu + vt = t(?) **[(u + v)]**
8. $ab^2 - ac^2 = ?x(b^2 - c^2)$ [**a**]
9. 5.4x2 + 5.4x3 + 5.4x4 + 5.4x5 + 5.4x6 = ? [**5.4x20 = 108**]
10. $z^3v + t^2v = (?)v$ [$z^3 + t^2$]
11. -3.4x(7.8 - 9.4) = ? [**5.4**]
12. (123 + 876 - 276)x0 = ? [**0**]
13. 54.5(21.4 + 87.3 - 17.4) [**4975.9**]
14. 0.02x(0.003 + 0.015) = ? [**0.00036**]
15. -17x(-6 - 9) = ? [**255**]

Take Quiz or do more exercises on P5ES

P5ES

DISTRIBUTIVE LAW + AND X COMBINED

Answers: [ ]'s

Distributive Law and Factoring

1. 13x(35 + 43) = ? [**1014**]
2. (3.5 - 4.9)x6.2 = ? [**-8.7**]
3. (7.9 + 43.7)x(4.1 + 13.4) = ? [**903**]
4. 42x69 + 42x82 = 42x(?) [**69 + 82 = 151**]
5. 579x7 - 579x6 = ? [**579**]
6. as + ad = ax(?) **[(s + d)]**
7. ta + bt = t(?) **[(a + b)]**
8. $ab^3 - abc^2 = ?x(b^2 - c^2)$ [**ab**]
9. abc - ac = acx? **[(b - 1)]**
10. $z^2v - vt^2 = (?)v$ [$z^2 - t^2$]
11. 33/4x(7/8 - 9/4) = ? [**-55/32 = -165/32 = -5.16**]
12. (12.3 + 886 - 276)x0 = ? [**0**]
13. 56.5(27.4 + 7.3 - 17.4) = ? [**977.5**]
14. 0.01x(0.008 + 0.015) = ? [**0.00023**]

Take Quiz or review

P6 LESSON: FRACTIONS, A/B AND C/D, RULES

Rules for adding and multiplying and dividing fractions

a, b, c, d represent arbitrary real numbers with b ≠ 0, d ≠ 0

1. a/b + c/d = (ad + bc)/bd

2. a/b - c/d = (ad - bc)/bd

3. (a/b)x(c/d) = (ac)/(bd)

4. (a/b) ÷ (c/d) = (a/b)x(d/c) = (ad)/(bc), now c ≠ 0 also

5. Rules regarding - same as in multiplication. - ÷ - = +

You may learn to do this manually, or you can learn to use the TI-30Xa calculator. It does restrict denominators to be less than 1000.

****

Review the calculator lessons C10, C11, and C12, if necessary.

Work problems along with Dr. Del as he does them:

2/3 + 3/4 = 17/12 = 1 5/12

(-1/2) (x 2/3) = -1/3

(-1/2)x(-2/3) = 1/3

(3/4)x(7/8) = 1 5/8 = 13/8 = 1.625

P6E

FRACTIONS, A/B AND C/D, RULES   Answers: [ ]'s

1. 2/3 + 3/4 = ?   [1 5/12 = 17/12 = 1.42]
2. 5 6/7 + 3 8/9 = ?   [9 47/63 = 9.75]
3. 1 7/8 − 1 1/2 = ?   [3/8]
4. 7/8 - 3/5 = ?   [11/40]
5. 6/7 x 3/8 = ?   [9/28]
6. 6/7 ÷ 3/8 = ?   [2 2/7 = 16/7 = 2.29]
7. Express 18/5 as a mixed fraction.   [3 3/5]
8. Express 18/5 in decimal form.   [3.6]
9. Express 0.35 as a fraction.   [7/20]
10. Express 4 7/8 as an improper fraction.   [39/8]
11. Express 4 7/8 as a decimal.   [4.875]
12. 3/4x(1 2/3 + 2 1/2) = ?   [3 1/8 = 25/8 = 3.125]
13. 2 3/4 - 23/8 = ?   [3/8]
14. 3 5/8 x 3 5/8 = ?   [13 9/64 = 13.14]
15. Express 2/3 as a decimal Real Number. [0.6667]
16. 1/a + 1/b = ?   [(a + b)/ab]

Take Quiz or do more exercises on P6ES

P6ES

FRACTIONS, A/B AND C/D, RULES   Answers: [ ]'s

1. 2/5 + 3/8 = ? [**31/40**]
2. 2 6/7 + 1 2/3 = ? [**4 11/21 = 95/21 = 4.5**]
3. 1 5/6 – 1 1/2 = ? [**1/3**]
4. 5/8 - 4/5 = ? [**-7/40**]
5. 4/7 x 5/8 = ? [**5/14**]
6. 4/7 ÷ 5/8 = ? [**32/35**]
7. Express 19/7 as a mixed fraction. [**2 5/7**]
8. Express 18/5 in decimal form. [**3.6**]
9. Express 0.22 as a fraction. [**11/50**]
10. Express 3 5/9 as an improper fraction. [**32/9**]
11. Express 3 5/9 as a decimal. [**3.56**]
12. 3/4 x(2 2/3 + 3 1/2) = ? [**4 5/8 = 37/8 = 4.625**]
13. 2 3/5 – 2 3/4 = ? [**-3/20 = -0.15**]
14. $(3\ 5/8)^2$ = ? [**13 9/64 = 841/64 = 13.1**]
15. 1/ab + 1/cb = ? **[(c + a)/(abc)]**

Take Quiz or review

P7 LESSON: SQUARES X^2 X SQUARED

$A^2 = AxA$ and we say: A squared

1. $(AB)^2 = A^2B^2$ Commutative Law yields this.

2. $(1/A)^2 = 1/A^2$

3. $(A + B)^2 = A^2 + 2AB + B^2$ Distributive Law yields this.

4. $(A - B)^2 = A^2 - 2AB + B^2$ Distributive Law again.

The x^2 Key will automatically square any number.

Work problems along with Dr. Del as you watch the video:

$(3x4)^2 = 144 = 3^2x4^2$ or (3x4)^2 = 144 = (3^2) x (4^2)

$(1/7)^2 = 1/7^2$

$(25.3)^2$ = (25.3)^2 = 640.09

$(-8)^2$ = (-8)^2 = 64

$A^2 > 0$ A^2 is positive, if A is non zero

P7E

SQUARES X^2 X SQUARED Answers: [ ]'s

1. $(34.5)^2 = ?$ **[1190.25]**

2. $(87)^2 = ?$ **[7569]**

3. $(-23)^2 = ?$ **[529]**

4. $(2.4^2 + 3.5^2)^2 = ?$ **[324.4]**

5. $(65.9)^2 = ?$ **[4343]**

6. $(89 + 57 - 32)^2 = ?$ **[12996]**

7. $(12.3)^2/7.6$ **[19.9]**

8. $(15.4 \div 0.35)^2 = ?$ **[1936]**

9. $(1 + 0.08)^2 = ?$ **[1.167]**

10. $(X + Y)^2 - X^2 - Y^2 = ?$ **[2XY]**

11. $(A - B)^2 - A^2 - B^2 = ?$ **[-2AB]**

12. $(3/4)^2 = ?$ **[9/16 = 0.5625]**

13. $3^2 + 4^2 = ?$ **[25 = 5^2]**

14. $(0.25)^2 = ?$ **[0.0625]**

Take Quiz or do more exercises on P7ES.

P7ES

SQUARES X^2 X SQUARED Answers: [ ]'s

1. $(3\ 4/5)^2 = ?$ **[14.44 = 14 11/25]**
2. $(8.7)^2 = ?$ **[75.7]**
3. $(-2/3)^2 = ?$ **[0.444 = 4/9]**
4. $(1.4^2 + 2.5^2)^2 = ?$ **[67.4]**
5. $(1\ 2/3 - 2\ 3/4)^2 = ?$ **[1.17 = 1 25/144]**
6. $(8.9 + 5.7 - 3.2)^2 = ?$ **[130.0]**
7. $(3.3)^2/(2.6)^2 = ?$ **[1.6]**
8. $(12.4 \div 0.85)^2 = ?$ **[212.8]**
9. $[(1 + 0.05)^2]^2 = ?$ **[1.22]**
10. $X^2 + Y^2 + 2XY = ?$ **[$(X + Y)^2$]**
11. $(0.01)^2 = ?$ **[0.0001]**
12. $(2/3)^2 = ?$ **[4/9 = 0.444]**
13. $1^2 + 2^2 + 3^2 + 4^2 + 5^2 = ?$ **[55]**
14. $(1.25)^2 = ?$ **[1.56]**

Take Quiz or review

P8 LESSON: SQUARE ROOTS √ X

√ A is a number whose square will equal A.

$(\sqrt{A})^2 = A$, √ A can be positive or negative

A must be positive or √ A will not be a real number.

The √ x Key will calculate the square root of any positive number and give you the positive square root.

√ x will return an Error message on the TI-30Xa if $x < 0$.

$\sqrt{a^2} = a$, $\sqrt{x}$ and x^2 are inverses, i.e., undo each other.

Note: $\sqrt{(a + b)} \neq \sqrt{a} + \sqrt{b}$

****

$\sqrt{9} = 3$ $(-3)^2 = 3^2 = 9$

$\sqrt{16} = 4$ $4^2 = 16$

$\sqrt{89} = 9.4$ Note: $(9.4)^2 = 88.36$

$\sqrt{2} = 1.414213562....$ "Irrational" Number Infinite non-repeating decimal

Irrational means NO fraction will equal √2

Fractions a/b, where a, b are integers, are called "Rational numbers"

√-6 Error "Complex Number"

$\sqrt{(12 + 54)} = 8.12$ where $\sqrt{12} + \sqrt{54} = 3.46 + 7.39 = 10.8$

You DO IT! Then "play with" the √ function, key.

P8E

SQUARE ROOTS √ X Answers: [ ]'s

1. $\sqrt{81}$ = ? [**9**]

2. $\sqrt{56.9}$ = ? [**7.5**]

3. $\sqrt{745365}$ = ? [**863**]

4. $\sqrt{(87)^2}$ = ? [**87**]

5. $(\sqrt{95})^2$ = ? [**95**]

6. $\sqrt{(9 + 16)}$ = ? [**5**]

7. $(1 + \sqrt{32})^2$ = ? [**44.3**]

8. $\sqrt{0.25}$ = ? [**0.5**]

9. $\sqrt{0.0001}$ = ? [**0.01**]

10. $(\sqrt{16} + \sqrt{9})^2$ = ? [**49**]

11. √(1/4 = ? [**1/2**]

12. $\sqrt{(1/2)}$ = ? [**0.707**]

13. $\sqrt{(9/16)}$ = ? [**3/4**]

14. $\sqrt{(-9)}$ = ? [**Error**]

Take Quiz or do more exercises on P8ES.

P8ES

SQUARE ROOTS √ X Answers: [ ]'s

1. $\sqrt{144}$ = ? [**12**]
2. $\sqrt{256}$ = ? [**16**]
3. $\sqrt{123456}$ = ? [**351.4**]
4. $\sqrt{(67)^2}$ = ? [**67**]
5. $(\sqrt{67})^2$ = ? [**67**]
6. $\sqrt{(3^2 + 4^2)}$ = ? [**$\sqrt{5^2} = 5$**]
7. $(\sqrt{23} + \sqrt{32})^2$ = ? [**109.3**]
8. $\sqrt{0.1111}$ = ? [**0.3333**]
9. $\sqrt{0.000001}$ = ? [**0.001**]
10. $\sqrt{0.00001}$ = ? [**0.0032**]
11. $\sqrt{(1/25)}$ = ? [**0.2 = 1/5**]
12. $\sqrt{(1+ 3 +5 + 7 +9)}$ = ? [**5**]
13. $\sqrt{(1+3+5+7+9+11+13+15)}$ = ? [**8**]
14. Do you see a pattern in the last two problems?

Take Quiz or review

P9 LESSON: RECIPROCAL 1/X X ≠ 0

1. $1/x = 1 \div x$ — $1/4 = 1 \div 4 = .25$
2. $1/(1/x) = x$ — 1/x is its own inverse
3. $1/a + 1/b = (a + b)/ab$ — see fractions
4. $(1/x)^2 = 1/x^2$ — see rules of exponents (P10)
5. $1/\sqrt{x} = \sqrt{(1/x)}$ — see rules of exponents (P10)

****

1/0 is undefined 1/0 Error Never divide by 0

1/1/4 = 4 1/x Key is its own inverse

1/9 = .1111111111…

$(1/3)^2 = 1/3^2 = 1/9 = .1111111111...$

$1/\sqrt{16} = 1/4 = \sqrt{(1/16)} = .25$

$\sqrt{.5} = .707$ and $.5 < .707$

P9E

RECIPROCAL 1/X, $X \neq 0$ Answers: [ ]'s

1. 1/7 = ? [**0.1429**]
2. 1/25 = ? [**0.04**]
3. 1/0.05 = ? [**20**]
4. 1/(0.1 + 0.2) = ? [**3.33**]
5. $(1/3.3)^2$ = ? [**0.0918**]
6. $1/(3.3)^2$ = ? [**0.0918**]
7. √(1/9) = ? [**1/3**]
8. $1/\sqrt{(3^2 + 4^2)}$ = ? [**0.2**]
9. 1/1/7 [**7**]
10. 1/0 [**Error**]
11. 1/(a + b) = ? **[1/(a + b)]**
12. 1/√9 = ? [**1/3**]
13. 1/(√16 + √25) [**0.111111111**]
14. $(1 + 1/10)^2$ = ? [**1.21**]
15. What operation is its own inverse? [**1/x**]

Take Quiz or do more exercises on P9ES

P9ES

RECIPROCAL 1/X, X ≠ 0 Answers: [ ]'s

1. $1/4 = ?$ [**0.25**]
2. $1/0.5 = ?$ [**2**]
3. $1/0.01 = ?$ [**100**]
4. $1/(0.3 + 0.4) = ?$ [**1.43**]
5. $(1/2.5)^2 = ?$ [**0.16**]
6. $1/(2.5)^2 = ?$ [**0.16**]
7. $\sqrt{(1/25)} = ?$ [**0.2 = 1/5**]
8. $1/(1\ 2/3) = ?$ [**0.6 =3/5**]
9. $1/1/(3.7) = ?$ [**3.7**]
10. $1/45^{0=}$? [**1**]
11. $1/1/a) = ?$ [**a**]
12. $1/\sqrt{49} = ?$ [**1/7 = 0.143**]
13. $1/1/1/1/1/1/5$ [**5**]
14. $1/1/1/1/1/1/1/5 = ?$ [**0.2 = 1/5**]

Take Quiz or review

P10 LESSON: EXPONENTS Y^X Y > 0, X CAN BE ANY NUMBER

Definitions $A^0 = 1$ y^x is sometimes used for y^x

1. $A^n = AxAx \ldots xA$, n times when n positive integer
2. $A^{1/n}$ is number such that $(A^{1/n})^n = A$
3. $A^{-n} = 1/A^n$ Negative exponents.
4. $A^{n/m} = (A^{1/m})^n$ Exponents defined for any rational number.
5. A^x can be defined for any real number. A > 0.

Rules of Exponents

6. $A^{n + m} = A^n x A^m$
7. $(A^n)^m = A^{nm}$

****

y^x y times itself x times, y is base, x is exponent or power

$3^4 = 81 : 4^3 = 64 : 2^3 = 8$

Name	Digital Base 2		Metric Base 10	
Kilo K	2^{10} =	1024	10^3 = 1000	Thousand
Mega M	2^{20} =	1048576	10^6 = 1000000	Million
Giga G	2^{30} =	11073741824	10^9 = 1000000000	Billion
Tera T	2^{40} =	You do it.	10^{12} =12 Zeros	Trillion

$8^{1/3} = 2$ $(987)^{1/3} = 9.956$

$9^{-2} = .0123 = 1/9^2$ $(16)^{-1/2} = .25 = 1/4$

$(81)^{-1/4} = .3333\ldots = 1/81^{1/4}$

$177{,}147 = 3^{11} = 3^{(4 + 7)} = 3^4 x 3^7 = 81x2187$

$9^3 = (3^2)^3 = 3^6 = 729$ $5^{2.6} = 65.66$

P10E

EXPONENTS Y^X ; Y > 0, X ANY NUMBER

Answers: [ ]'s

1. 2^8 = ? [256]

2. 12^3 = ? [1728]

3. $(17.1)^4$ = ? [85504]

4. 10^9 = ? [1,000,000,000]

5. $(1 + 0.06)^{20}$ = ? [3.2]

6. $15^{2.7}$ = ? [1498]

7. $1/(0.5)^4$ = ? [16]

8. $25^{1/2}$ = ? [5]

9. $81^{1/4}$ = ? [3]

10. 5^{-2} = ? [0.04 = 1/25]

11. 2^{30} = ? [1,073,741,824 1 GIG]

12. $1000x(1.06)^{100}$ = ? [339,302]

13. $1000x(1.07)^{100}$ = ? [867,716]

14. $26x(1 + 0.06)^{400}$ = ? [$3.446x10^{11}$ = 344,600,000,000]

Take Quiz or do more exercises on P10ES.

P10ES

EXPONENTS Y^X ; Y > 0, X ANY NUMBER

Answers: [ ]'s

1. 2^{10} = ? [1,024 K]
2. 2^{20} = ? [1,048,576 M]
3. 2^{30} = ? [1,073,741,824 G]
4. 10^3 = ? [1,000 K]
5. 10^6 = ? [1,000,000 M]
6. 10^9 = ? [1,000,000,000 G]
7. $1/5^2$ = ? [0.04]
8. 5^{-2} = ? [0.04]
9. $1281^{1/4}$ = ? [5.98]
10. $(5.98)^4$ = ? [1279]
11. 2^{64} = ? [1.845×10^{19}]
12. $(1.02)^{2000}$ = ? [158,000,000,000,000,000]

[$1 invested at time of Christ's birth earning 2% per year compounded would be more money than in the world today. 1% would yield only 440 million.]

Take Quiz or review

INTRODUCTION TO ALGEBRA

Algebra is a "technology" for finding unknown numbers, **X**, **Y**, **Z**, etc., from known numbers **A**, **B**, **C**, etc. In our Foundation course, we will only deal with one unknown number, usually denoted **X**, but we could denote it with any symbol.

The Algebra technique is to create an Equation involving the unknown number **X** and the known numbers **A**, **B**, **C**, etc., based on their known relationships and then "solving" the equation for the unknown, and checking the answer.

Step 1 is to "**create**" the equation between **X** and the knowns.

Step 2 is to "**solve**" this equation by finding out what value of **X** makes the equation true when substituted for **X**.

Step 3 is to "**verify**" or "**check**" the solution by making the substitution.

Simple Example: [Word Problem] Three years from now Mary will be twice as old as Joe who is 7 years old today. How old is Mary now?

Step 1. Let **X** be Mary's age today. This is the unknown we want to find. In three years Mary will be **X + 3** years old. In three years Joe will be **7 + 3 = 10** years old. So, we are given that in three years **X + 3 = 2x10 = 20**

Step 2. Solve the equation. By trial and error, it appears **17** might be the answer.

Step 3. Check. Substitute **17** for **X**. **17 + 3 = 20**. So, **17** is the answer.

Now, in general, it is not too hard to do Step 1. Define what X stands for and then relate the given facts to X and create an equation.

Step 2 can be very easy; or, very difficult, to solve. In the Foundation course, we will deal with equations that arise in many common situations, and these are usually easy to solve.

Step 3 is quite easy with a calculator.

A1 LESSON: FOUR WAYS TO SOLVE AN ALGEBRA EQUATION

Suppose you have an equation with one unknown, **X**. How can you solve it?

There are essentially four ways.

1. **Guess the answer**. Check to see if you are right. This is a good way with really simple equations. It can be the best way with very complicated equations **IF** you have a computer to help. This is then called **Numerical Analysis**.

2. **Apply a Formula**. This is fine **IF** you know an appropriate formula. This is useful if you are solving the same type of equation frequently and have the formula available. However, it can be quite difficult to find or remember the correct formula. Formulas are often given in Handbooks for special situations.

3. **Apply a Process**. This is the best way for certain equations, and it is how we will solve most of our equations in this Foundation course, and in the real world.

4. **Apply a Power Tool**. This is the best way for complex equations. One great tool for this is Mathematica. This is how engineers solve most of their equations. But, you must learn to use this tool first. We will cover it extensively in the upper Tiers in our advanced training. If also applies to other types of equations.

In our Foundation course, we will learn to **Apply a Process**. This usually is easier than trying to find the correct formula. It is faster and more accurate for certain types of equations we will be dealing with.

A1E

Four Ways to Solve an Algebra Equation

Suppose you have an equation with one unknown, X. How can you solve it?

What are the Four Ways to solve an equation?

1.

2.

3.

4.

Which way will be utilize and learn in the Foundations Course? Why?

A1EA

Four Ways to Solve an Algebra Equation

Suppose you have an equation with one unknown, X. How can you solve it?

What are the Four Ways to solve an equation?

1. Guess the answer. Check to see if you are right. This is a good way with really simple equations. It can be the best way with very complicated equations IF you have a computer to help. This is then called Numerical Analysis.

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Which way will be utilize and learn in the Foundations Course? Why?

In our Foundation course, we will learn to Apply a Process. This usually is easier than trying to find the correct formula. It is faster and more accurate for certain types of equations we will be dealing with.

A1ES

Four Ways to Solve an Algebra Equation

1. In the PMF, what do we want to know about an Algebra Equation?

2. Why do we normally use Applying a Process instead of Applying a Formula to solve algebra equations?

A1ESA

Four Ways to Solve an Algebra Equation   Answers: [ ]

1. In the PMF, what do we want to know about an Algebra Equation?

[**We want to see if we can find the value of the unknown in the equation, most generally denoted by X!**]

2. Why do we normally use Applying a Process instead of Applying a Formula to solve algebra equations?

[**Applying a Formula only works for special types of problems and specific formulas, and requires a good deal of memorization. Applying a Process allows us to work with many types of equations with needing to memorize specific formulas!**]

A2 LESSON: THE RULE OF ALGEBRA

Suppose we have an equation to solve. It will have a Left Side (**LS**) and a Right Side (**RS**) either of which might contain the unknown, **X**, and other known numbers. (Any letter could be the unknown.)

Equation: **LS** = **RS** Can switch sides **RS** = **LS**

THE RULE of Equation Solving is: You may do the same thing to both sides of the equation and obtain a new equation:

1. **LS** + A = **RS** + A, **LS** - A = **RS** − A Add or Subtract a Number to both sides of the equation.
2. **LS**xA = **RS**xA, **LS**÷A = **RS**÷A Multiply or Divide a Number
3. 1/**LS** = 1/**RS** Invert both sides
4. $(LS)^2 = (RS)^2$ Square both sides
5. √**LS** = √**RS** Square Root Both Sides
6. SIN (**LS**) = SIN (**RS**) Take the SIN of both sides.
7. Any legitimate math operation to both sides.

The idea is to apply a sequence of operations or transformations to both sides until you arrive at:

X = Number "The Solution"

Then <u>**check your answer**</u> by substituting this Number into the Equation in place of **X** and see that both sides are equal.
We will see many examples of this in the lessons to follow. These are the kinds of Equations you will be solving in the "real world."

A2E

THE RULE OF ALGEBRA

Suppose we have an equation to solve. It will have a Left Side (**LS**) and a Right Side (**RS**) either of which might contain the unknown, **X**, and other known numbers. (Any letter could be the unknown.)

Equation: **LS** = **RS** Can switch sides **RS** = **LS**

1. What is **THE RULE** of Equation Solving?

2. Give examples of applying this Rule.

3. Describe the process you will use to solve an equation using this Rule.

4. After you have a solution: **X** = Number, what should you always do, especially if the answer is important?

THE RULE OF ALGEBRA

Suppose we have an equation to solve. It will have a Left Side (**LS**) and a Right Side (**RS**) either of which might contain the unknown, **X**, and other known numbers. (Any letter could be the unknown.)

Equation: **LS** = **RS** Can switch sides **RS** = **LS**

1. **THE RULE** of Equation Solving is: *You may do the same thing to both sides of the equation and obtain a new equation:*

2. Examples:

1) **LS** + **A** = **RS** + **A**, **LS** - **A** = **RS** - A (add or subtract a number to both sides of the equation)
2) **LS**x**A** = **RS**x**A**, **LS**÷**A** = **RS**÷**A** (multiply or divide a number)
3) 1/**LS** = 1/RS (invert both sides)
4) $(\mathbf{LS})^2 = (\mathbf{RS})^2$ (square both sides)
5) √**LS** = √**RS** (square root both sides)
6) SIN (**LS**) = SIN (**RS**) (take the SIN of both sides)
7) Any legitimate math operation to both sides.

3. The idea is to apply a sequence of operations or transformations to both sides until you arrive at:

X = Number "**The Solution**"

4. Then <u>check your answer</u> by substituting this Number into the Equation in place of **X** and see that both sides are equal.

We will see many examples of this in the lessons to follow. These are the kinds of Equations you will be solving in the "real world."

THE RULE OF ALGEBRA

1. When solving an equation, any math operation (adding, subtracting, multiplying, etc.) done to one side of the equation must be ____________________________. *fill in the blank*

2. If we solved the equation X + 3 = 8, and got X = 6, what IMPORTANT STEP would help us realize we made a mistake?

A2ESA

THE RULE OF ALGEBRA Answers: [ ]

1. When solving an equation, any math operation (adding, subtracting, multiplying, etc.) done to one side of the equation must be [done to the other side of the equation].

2. If we solved the equation X + 3 = 8, and got X = 6, what IMPORTANT STEP would help us realize we made a mistake? [**If we checked our solution by plugging it back into the original equation we would see that X = 6 gives 9 = 8, which is obviously incorrect!**]

A3 LESSON: X + A = B THIS IS AN EASY LINEAR EQUATION

What can you do to both sides to get closer to a solution?

X + **A** - **A** = **B** - **A** [subtract **A** from both sides] [transpose **A**]

Thus: X = **B** – **A** since **A** - **A** = **0** and X + **0** = X

Example: X + 2 = 5 [subtract **2** from both sides]

Solution: X = X + 2 - 2 = 5 - 2 = 3

Example: X - 7 = -13 [add **7** to both sides]

Solution: X = X - 7 + 7 = -13 + 7 = -6 [we have transposed **7**]

Example: 8.13 = -7.19 + X

Same as: X - 7.19 = 8.13 [since can switch sides]

Solution: Add 7.19 to both sides. X = 15.32 (use calculator)

Example: X + (-18.4) = +√37.9

Same as: X - 18.4 = 6.16 [take square root +(-) = -]

X = X - 18.4 + 18.4 = 6.16 + 18.4 = 24.56 = 24.6

[add 18.4]

Example: X - **SIN**(37º) = [COS(68º)]2 [do not be intimidated

SIN(37º) = .6018 COS(68º) = .3746 $(.3746)^2$ = .1403

SO: X - .6018 = .1403 and

THUS: X = .7421

A3E

X + A = B THIS IS AN EASY LINEAR EQUATION

X + A - A = B - A [subtract A from both sides] [transpose A]

Thus: X = B – A **since** A - A = 0 **and** X + 0 = X

Solve for X, the Unknown

1. X + 42 = 59
2. X - 17 = -43
3. 8.13 = -17.19 + X
4. X + (-28.4) = +√87.9
5. 6.5 - X = 23.5
6. 5432 = X + 4375
7. X - √675 = √9876
8. X - 3/4 = 9/13
9. 6/7 = 8/11 – X
10. 0.00035 + X = 0.0017
11. X - **SIN**(37°) = [**COS**(68°)]^2
12. **COS**(48°) = **TAN**(78°) – X
13. (13.4 + 9.7)^2 + X = 87.4^2

A3EA

X + A = B THIS IS AN EASY LINEAR EQUATION Answers: [ ]

X + A - A = B - A [**subtract A from both sides**] [**transpose A**]

Thus: X = B – A **since** A - A = 0 **and** X + 0 = X

1. X + 42 = 59 [**17**]
2. X - 17 = -43 [**-26**]
3. 8.13 = -17.19 + X [**25.32**]
4. X + (-28.4) = +√87.9 [**37.8**]
5. 6.5 - X = 23.5 [**-17**]
6. 5432 = X + 4375 [**1057**]
7. X - √675 = √9876 [**125.4**]
8. X - 3/4 = 9/13 [**75/52=123/52**]
9. 6/7 = 8/11 – X [**-10/77**]
10. 0.00035 + X = 0.0017 [**0.00135**]
11. X - **SIN**(37^o) = [**COS**(68^o)]^2 [**0.742**]
12. **COS**(48^o) = **TAN**(78^o) – X [**4.035**]
13. $(13.4 + 9.7)^2$ + X = 87.4^2 [**7105.2**]

A3ES

X + A = B THIS IS AN EASY LINEAR EQUATION

Answers: [ ]

1.	$X + 54 = 100$	[X = 46]
2.	$8.7 - X = 4.9$	[X = 3.8]
3.	$X + (-0.567) = 3.14$	[X = 3.707]
4.	$X + \sqrt{25} = 10$	[X = 5]
5.	$17^2 - X = 100$	[X = 189]
6.	$X - SIN(30°) = 1$	[X = 1.5]
7.	$X - 5/6 = 4/5$	[X = 1.633]
8.	$7/6 = 8/5 - X$	[X = 0.433]
9.	$0.3017^4 + X = 0.0012^2$	[X = -0.0083]
10.	$[COS(180°)]^2 - X = SIN(270°)$	[X = 2]
11.	$\pi - X = \pi/2$	[X = π/2]
12.	$(2^3 + X) - 4 = (2^2 + 3^2)$	[X = 9]

A4 LESSON: AX = B THIS IS AN EASY LINEAR EQUATION

What can you do to both sides to get closer to a solution?

X = AX/A = B/A [divide both sides by **A**] **Note**: A/A = 1

Example: 3X = 12

Solution: X = 3X/3 = 12/3 = 4 [divide by **3** both sides always]

Example: 2.16X = -56.3

Solution: X = -56.3/2.16 = -26.0648 = -26.1

Example: -37.8 = -6.78X

Solution: -6.78X = -37.8 [switch sides]

Then: X = (-37.8)/(-6.78) = 5.6 [divide by -6.78]

Example: $(3.85)^2X = \sqrt{349}/\text{SIN}(79^0)$ [easy does it!]

$(3.85)^2 = 14.8$ $\sqrt{349} = 18.7$ **SIN** $(79^0) = .982$

So: 14.8X = 18.7/.982 = 19.0 X = 1.29 [divide by 14.8]

Always simplify the numbers first, and then solve the equation. The calculator makes this easy. Also, always **CHECK** your answer by plugging it back into the equation and being sure both sides are equal.

$(3.85)^2$x1.29 = 19.1 $\sqrt{349}/\text{SIN}(79^o) = 19.0$ [round off error]

A4E

AX = B   THIS IS AN EASY LINEAR EQUATION

What can you do to both sides to get closer to a solution?

$X = AX/A = B/A$ [divide both sides by **A**] **Note**: $A/A = 1$

Solve for **X,** the Unknown

1. $4X = 12$
2. $2.16X = -56.3$
3. $-37.8 = -6.78X$
4. $0.003X = 0.15$
5. $(4/5)X = 7/9$
6. $(1+3)^2 X = \sqrt{65}$
7. $(3.85)^2 X = \sqrt{349} / \mathbf{SIN}(79^0)$ {Easy does it!}
8. $(1 + 2/3) = (7/12)X$
9. $2345X = 9876$
10. $54.5 = -87.7X$
11. $\mathbf{COS}(32^o)X = 3\mathbf{SIN}(32^o)$
12. $X = 3\mathbf{TAN}(32^o)$

A4EA

AX = B THIS IS AN EASY LINEAR EQUATION Answers: [ ]

What can you do to both sides to get closer to a solution?

$X = AX/A = B/A$ [divide both sides by **A**] **Note**: $A/A = 1$

Solve for **X,** the Unknown

1. $4X = 12$	[**3**]
2. $2.16X = -56.3$	[**-26.1**]
3. $-37.8 = -6.78X$	[**5.58**]
4. $0.003X = 0.15$	[**50**]
5. $(4/5)X = 7/9$	[**35/36 = 0.97**]
6. $(1+3)^2X = \sqrt{65}$	[**0.5**]
7. $(3.85)^2X = \sqrt{349}/\text{SIN}(79^0)$	[**1.28**]
8. $(1 + 2/3) = (7/12)X$	[**20/7 = 2 6/7 = 2.86**]
9. $2345X = 9876$	[**4.2**]
10. $54.5 = -87.7X$	[**-0.62**]
11. $\text{COS}(32^o)X = 3\text{SIN}(32^o)$	[**1.875**]
12. $X = 3\text{TAN}(32^o)$	[**1.875**]

A4ES

AX = B THIS IS AN EASY LINEAR EQUATION Answers: [ ]

1. $5X = 27.25$ [**X = 5.45**]
2. $67 - 2 = 13X$ [**X = 5**]
3. $5.1X - 3 = 2.1$ [**X = 1**]
4. $9 = 3X + 17$ [**X = - 2.6**]
5. $(5^2)X = 1000$ [**X = 40**]
6. $\text{TAN}(30°)X = 18$ [**X = 31.18**]
7. $(\sqrt{169})X = 26$ [**X = 2**]
8. $(-7/8) = (-8/5)X$ [**X = 0.5469**]
9. $[\text{SIN}(60°)]^2X = 3$ [**X = 4**]
10. **In the equation AX = B, when solving it we would divide B by A. Notice how dividing B by A is the same as MULTIPLYING B by (1/A).** In the equation, $(2/3)X = 2$, we would solve by dividing 2 by (2/3). If we want to think in terms of multiplication, what we would multiply 2 by instead?

    [**We would think of multiplying 2 by the reciprocal of 2/3, which is 3/2.**]

11. $(\sqrt{36})[\text{COS}(60°)]^2 = \text{SIN}(270°)X$ [**X = -1.5**]
12. $3X + 3X + 3X = -0.62612$ [**X = -0.0696**]

A5 LESSON: AX+B = CX+D THIS IS AN EASY LINEAR EQUATION

What can you do to both sides to get closer to a solution?

Get all the X terms on one side and numbers on other side.

AX - CX = D - B or (A - C)X = D - B [distributive law]

X = (D - B)/(A - C) [divide both sides by (A - C)]

Example: 3X + 7 = 5 - 7X

Solution: 3X + 7X = 5 – 7 **or** 10X = -2 **or** X = -2/10 = -.5

Example: -18.3X + 4.6X - 22.4 = 13.9X - 45.4 + 3.9X

-18.3X + 4.6X -13.9X - 3.9X = -45.4 + 22.4

(-18.3 + 4.6 -13.9 -3.9)X = -31.5X = -23.0

X = -23.0/-31.5 = .730

Once again…always do the numerical calculations first.

Example: $(2.13)^2$X - **LOG**(345) = 1/**COS**(12.5°) + $\sqrt{(5 + 1/.15)}$X

$(2.13)^2$ = 4.54 **LOG** (345) = 2.54

COS(12.5°) = .976 1/.976 = 1.024

and: $\sqrt{(5 + 1/.15)} = \sqrt{(5 + 6.67)}$ = 3.42 [easy w/calculator]

4.54X - 2.54 = 1.024 + 3.42X

or: (4.54 - 3.42)X = 1.024 + 2.54

1.12X = 3.56

X = 3.56/1.12 = 3.18 [you check the answer]

$(2.13)^2$x3.18 - **LOG** (345) = 11.9 = 1/**COS** (12.5°) +

√ (5 + 1/.15)3.18

A5E

AX + B = CX + D THIS IS AN EASY LINEAR EQUATION.

Solve for **X**, the Unknown. **Note:** The Algebra is easy. The arithmetic can be complicated but easy with the **TI-30Xa**.

1. $3X + 7 = 5 - 7X$
2. $3.2X - 9 = 4.1X + 7.8$
3. $-12X - 98 = 23X + 76$
4. $0.002X - 0.015 = 0.0087 - 0.005X$
5. $(3/4)X - 2/7 = (4/5)X + 3/8$
6. $\mathbf{SIN}(28^o)X - 1.4 = \mathbf{COS}(28^o)X + 2.3$
7. $-18.3X + 4.6X - 22.4 = 13.9X - 45.4 + 3.9X$
8. $(2.13)^2X - \mathbf{LOG}(345) = 1/\mathbf{COS}(12.5^o) + \sqrt{(5 + 1/0.15)}\ X$
9. $2\ 5/6X - 7.1 = 7\ 2/3X + 3.2$
10. $(1/7)X + 2/3 = (3/8)X - 4/9$
11. $2.4 - 3.5X = 7.8 - 1.2X$
12. $(\mathbf{LOG}54)X + 45^2 = \mathbf{SIN}(45^o) - (4.5)^2X$
13. $X - \mathbf{LN}(60) = 3 - 2X$
14. $45 - 17X = 8X + 76$

A5EA

AX + B = CX + D This is an easy Linear Equation Answers: [ ]

Solve for **X**, the **Unknown**. **Note:** The Algebra is easy. The arithmetic can be complicated but easy with the **TI-30Xa**.

1. 3**X** + 7 = 5 - 7**X** [**-0.2**]
2. 3.2**X** - 9 = 4.1**X** +7.8 [**-18.7**]
3. -12**X** - 98 = 23**X** + 76 [**-4.97**]
4. 0.002**X** - 0.015 = 0.0087 - 0.005**X** [**3.39**]
5. (3/4)**X** - 2/7 = (4/5)**X** + 3/8 [**-13 3/14 = -185/14 = -13.21**]
6. **SIN**(28°)**X** - 1.4 = **COS**(28°)**X** +2.3 [**-8.95**]
7. -18.3**X** + 4.6**X** - 22.4 = 13.9**X** - 45.4 + 3.9**X** [**0.73**]
8. $(2.13)^2$**X** - **LOG**(345) = 1/**COS**(12.5°) + $\sqrt{(5 + 1/.15)}$**X** [**3.18**]
9. 2 5/6**X** - 7.1 = 7 2/3**X** + 3.2 [**-2.13**]
10. (1/7)**X** + 2/3 = (3/8)**X** - 4/9 [**4 92/117 = 560/117 =4.79**]
11. 2.4 - 3.5**X** = 7.8 - 1.2**X** [**-2.35**]
12. (**LOG**54)**X** + 45^2 = **SIN**(45°) - $(4.5)^2$**X** [**-92.09**]
13. **X** - **LN**(60) = 3 - 2**X** [**2.37**]
14. 45 - 17**X** = 8**X** + 76 [**-1.24**]

A5ES

AX + B = CX + D **This is an easy Linear Equation**   Answers: [ ]

1. $4x - 17 = -35 - 5X$ [**X = -2**]
2. $25 + 3.5X = -25 + 7.5X$ [**X = 12.5**]
3. $6^2X - 24 = 36 + 18X$ [**X = 3.333**]
4. $0.375 + 4.25X = 1.525 - 8.125X$ [**X = 0.0929**]
5. $SIN(45°)X - 4 = 12 - COS(45°)X$ [**X = 11.31**]
6. $(\sqrt{144})X - 2^4 = 3^3 + (\sqrt{36})X$ [**X = 7.167**]
7. $LOG(15)X + 1 = LN(25) + 2X$ [**X = -2.693**]
8. $1/COS(0°) -4X = -1/SIN(90°) + (3/4)X$ [**X = 0.421**]
9. $\pi X - 2/3\pi = 3\pi X - 8/3\pi$ **HINT: What can be removed from both sides of the equation?**

   [**Since Pi is on either side of the equation, it can be removed.**]
   [**X = 1**]

10. $2TAN(45°)X + 2X - 0.375 = SIN(12.5°)X - \sqrt{0.025}$

    [**X = 0.0573**]
11. $(1/4)^2X - 25.67 = 27X + 6.022$ [**X = -1.176**]
12. $[LN(25-7.4)]^2X - 17 = 1/LOG(2) - 3COS(37°)X$

    [**X = 1.19**]

A6 LESSON: A/X = C/D THIS IS AN EASY LINEAR EQUATION

What can you do to both sides to get closer to a solution?

Flip both sides: $X/A = D/C$ **then** $X = Ax(D/C)$

Example: $3/X = 12/5$

Solution: $X/3 = 5/12$ **then** $X = 3x(5/12) = 1.25$

Example: $2.16/X = -56.3$ **then** $X/2.16 = 1/-56.3$

Solution: $X = 2.16/-56.3 = -.038$ (check: $2.16/-.038 = -56.8$)

Example: $-37.8 = -6.78/X$

Solution: $-6.78/X = -37.8$ (switch sides)

Then: $X = (-6.78)/(-37.8) = .18$ (flip and multiply by -6.78)

Example: $(3.85)^2/X = \sqrt{349}/\text{SIN}(79^0)$

$(3.85)^2 = 14.8$ $\sqrt{349} = 18.7$ $\text{SIN}(79^0) = .982$

So: $14.8/X = 18.7/.982 = 19.0$ **or** $X = 14.8/19.0 = .78$

Always simplify the numbers first, and then solve the equation. Also, always **CHECK** your answer by plugging it back into the equation and being sure both sides are equal.

$(3.85)^2/.78 = 19.0$ $\sqrt{349}/\text{SIN}(79^o) = 19.0$

A6E

A/X = C/D THIS IS AN EASY LINEAR EQUATION.

Flip both sides: **X**/A = D/C **then** **X** = Ax(D/C)

Solve for **X,** the **Unknown**. **Note:** The Algebra is easy. The arithmetic can be complicated but easy with the **TI-30Xa**.

1. $3/X = 12/5$
2. $2.16/X = -56.3$
3. $-37.8 = -6.78/X$
4. $(3.85)^2/X = \sqrt{349}/\text{SIN}(79^0)$

Always simplify the numbers first and then, solve the equation. Also, always **CHECK** your answer by plugging it back into the equation and being sure both sides are equal.

5. $\text{SIN}(23^o)/X = \text{COS}(54^o)$
6. $23^2 = (12.5)^2/X$
7. $(3/4)/X = 9/16$
8. $\text{LOG}(4235)/X = \text{LN } 435$
9. $10.5/X = 9.8/4.1$
10. $(5^2 + 7^2)/X = 1/(0.05)^2$
11. $\text{COS}(37^o)/\text{SIN}(37^o) = 1/X$

A6EA

A/X = C/D This is an easy Linear Equation Answers: [ ]

Flip both sides: **X**/A = D/C **then** **X** = Ax(D/C)

Solve for **X,** the **Unknown**. **Note:** The Algebra is easy. The arithmetic can be complicated but easy with the **TI-30Xa**.

1. 3/**X** = 12/5 [**1.25**]
2. 2.16/**X** = -56.3 [**-0.038**]
3. -37.8 = -6.78/**X** [**0.179**]
4. $(3.85)^2$/**X** =√349/ **SIN**(79^0) [**0.779**]

Always simplify the numbers first, and then solve the equation. Also, always **CHECK** your answer by plugging it back into the equation and being sure both sides are equal.

5. **SIN**(23^o)/**X** = **COS**(54^o) [**0.665**]
6. 23^2 = $(12.5)^2$/**X** [**0.295**]
7. (3/4)/**X** = 9/16 [**1 1/3 = 4/3 = 1.33**]
8. **LOG**(4235)/**X** = **LN** 435 [**0.597**]
9. 10.5/**X** = 9.8/4.1 [**4.39**]
10. (5^2 + 7^2)/**X** = 1/$(0.05)^2$ [**0.185**]
11. **COS**(37^o)/**SIN**(37^o) = 1/**X** [**0.754**]

A6ES

A/X = C/D This is an easy Linear Equation Answers: [ ]

1. 4/X = 1 [X = 4]
2. 10/X = 2/4 [X = 20]
3. 17/X = 1/17 [X = 289]
4. SIN(30°)/X = 1/COS(60°) [X = 0.25]
5. 25.3/X = -98.1/27.6 [X = -7.12]
6. (√225)/X = 12/19 [X = 23.75]
7. 23.6/-0.025 = 1112/X [X = -1.178]
8. SIN(56°)/X = COS(27°) [X = 0.93]
9. TAN(75°)/COS(23.5°) = SIN(14°)/X [X = 0.0594]
10. LOG(92)/X = 15/LN(25) [X = 0.4214]
11. π/X = 1/2 [X = 2π]
12. -COS(180°)/2X = 43SIN(25°)/3.643 [X = 0.1002]

A7 LESSON: $AX^2 = B$ THIS IS AN EASY NON-LINEAR EQUATION

What can you do to both sides to get closer to a solution?

$X^2 = B/A$ (divide by A) **now** take the square root both sides

$X = \sqrt{(B/A)}$ [**Note:** Answer could be **+** or **-**]

Example: $X^2 = 387$ $X = 19.7$ **or** -19.7 [$\sqrt{387} = 19.7$]

Example: $\text{SIN}(125^o)X^2 = (5.4 + 3.4)^2$ (simplify numbers first)

$\text{SIN}(125^o) = .819$ $(5.4 + 3.4)^2 = (8.8)^2 = 77.4$

So: $.819X^2 = 77.4$ **or** $X^2 = 77.4/.819$ **or** $X^2 = 94.55$

So: $X = 9.7$

Check: $\text{SIN}(125^o)x(9.7)^2 = 77.07$ [close enough due to **r/o**]

Note: $X = \sqrt{94.55} = 9.724$ to more digits

Then: $\text{SIN}(125^o)x(9.724)^2 = 77.5$

Always be aware of how many digits are really significant and the unavoidable round off (**r/o**) error. Ask yourself: How accurate or precise can I measure, or do I need to measure?

A7E

$AX^2 = B$ THIS IS AN EASY NON-LINEAR EQUATION

$X^2 = B/A$ (divide by A) **now** take the square root both sides

$X = \sqrt{(B/A)}$ [**Note:** Answer could be **+** or **-**]

Solve for **X,** the **Unknown**. **Note:** The Algebra is easy. The arithmetic can be complicated but easy with the **TI-30Xa**.

1. $X^2 = 387$
2. $\mathbf{SIN}(125^o)X^2 = (5.4 + 3.4)^2$
3. $X^2 = 23^2$
4. $X^2 = (\sqrt{78})^2$
5. $X^2 = \mathbf{LOG}(98)$
6. $\mathbf{SIN}(34^o) = \mathbf{COS}(23^o)X^2$
7. $(3/4)X^2 = 9/16$
8. $X^2 = 16A^2$
9. $X^2 = (\mathbf{SIN}(78^o))^2 + (\mathbf{COS}(78^o))^2$
10. $X^2 = \mathbf{COS}^{-1}[(3^2 + 4^2 - 6^2)/2x3x4]$
11. $X^2 = \sqrt{81}$

A7EA

$AX^2 = B$ **THIS IS AN EASY NON-LINEAR EQUATION** Answers:[ ]

$X^2 = B/A$ (divide by A) **now** take the square root both sides

$X = \sqrt{(B/A)}$ [**Note:** Answer could be **+** or **-**]

Solve for **X,** the **Unknown**. **Note:** The Algebra is easy. The arithmetic can be complicated but easy with the **TI-30Xa**.

1. $X^2 = 387$ [**19.7**]
2. $SIN(125^o)X^2 = (5.4 + 3.4)^2$ [**9.7**]
3. $X^2 = 23^2$ [**23**]
4. $X^2 = (\sqrt{78})^2$ [**√78**]
5. $X^2 = LOG(98)$ [**1.41**]
6. $SIN(34^o) = COS(23^o)X^2$ [**0.779**]
7. $(3/4)X^2 = 9/16$ [**0.866**]
8. $X^2 = 16A^2$ [**4A**]
9. $X^2 = (SIN(78^o))^2 + (COS(78^o))^2$ [**1**]
10. $X^2 = COS^{-1}[(3^2 + 4^2 - 6^2)/2x3x4]$ [**10.8**]
11. $X^2 = \sqrt{81}$ [**3**]

A7ES

$AX^2 = B$ THIS IS AN EASY NON-LINEAR EQUATION Answers:[ ]

1. $X^2 = 81$ [$X = \pm 9$]
2. $X^2 = 169$ [$X = \pm 13$]
3. $3X^2 = 45$ [$X = \pm 3.87$]
4. $X^2 = 275^2$ [$X = \pm 275$]
5. $SIN(35°)X^2 = 65$ [$X = \pm 10.645$]
6. $(3/7)X^2 = (19/8)$ [$X = \pm 2.354$]
7. $LOG(8.756)X^2 = LN(253)$ [$X = \pm 2.423$]
8. $X^2 = \pi^2$ [$X = \pm \pi$]
9. $3X^2 = \sqrt{121}$ [$X = \pm 1.915$]
10. $X^2 = SIN(65°) - COS(45°)$ [$X = \pm 0.4463$]
11. $4X^2 = (2^4 + 3^3 + 4^2)^2$ [$X = \pm 29.5$]
12. $X^2 = (3\pi^2)^2$ [$X = \pm 3\pi^2$]

A8 LESSON: $A\sqrt{X} = B$ THIS IS AN EASY NON-LINEAR EQUATION

What can you do to both sides to get closer to a solution?

$\sqrt{X} = B/A$ (divide by A) **now** take the square both sides

$X = (B/A)^2$ [**Note:** Answer will be positive]

Example: $\sqrt{X} = 387$ $X = 149{,}769$ which is $(387)^2$

How many digits are significant…**probably 3.**
150,000 is good enough.

Example: **SIN**$(125^o)\sqrt{X} = (5.4 + 3.4)^2$ (simplify numbers first)

SIN$(125^o) = .819$ $(5.4 + 3.4)^2 = (8.8)^2 = 77.4$

So: $.819\sqrt{X} = 77.4$ **or** $\sqrt{X} = 77.4/.819$ **or** $\sqrt{X} = 94.55$

or $X = 8940$

Check: **SIN**$(125^o) \times \sqrt{8940} = 77.4$

Always be aware of how many digits are really significant and the unavoidable round off (**r/o**) error. Ask yourself: How accurate or precise can I measure, or do I need to measure?

A8E

$A\sqrt{X} = B$ This is an easy non-Linear Equation

$\sqrt{X} = B/A$ (divide by A) **now** take the square both sides

$X = (B/A)^2$ [**Note:** Answer will be positive]

Solve for **X,** the **Unknown**. **Note:** The Algebra is easy. The arithmetic can be complicated but is easy with the **TI-30Xa**.

1. $\sqrt{X} = 387$
2. $\sqrt{X} = -23.5$
3. $\sqrt{X} = 7/8$
4. $3.5\sqrt{X} = 98.2$
5. $78 = 4.2\sqrt{X}$
6. $\sqrt{X} = 6^2$
7. $\sqrt{X} = \sqrt{17}$
8. $\mathbf{SIN}(125^o)\sqrt{X} = (5.4 + 3.4)^2$ (simplify numbers first)
9. $\sqrt{X} = \mathbf{LOG}(6754)$
10. $\sqrt{X} = \mathbf{SIN}^2(65^o) + \mathbf{COS}^2(65^o)$

A8EA

$A\sqrt{X} = B$ This is an easy non-Linear Equation

Answers:[ ]

$\sqrt{X} = B/A$ (divide by A) **now** take the square both sides

$X = (B/A)^2$ [**Note:** Answer will be positive]

Solve for **X,** the **Unknown**. **Note:** The Algebra is easy. The arithmetic can be complicated but easy with the **TI-30Xa**.

1. $\sqrt{X} = 387$	[**149,769**]
2. $\sqrt{X} = -23.5$	[**552.25**]
3. $\sqrt{X} = 7/8$	[**0.766 or 49/64**]
4. $3.5\sqrt{X} = 98.2$	[**787**]
5. $78 = 4.2\sqrt{X}$	[**345**]
6. $\sqrt{X} = 6^2$	[**1296**]
7. $\sqrt{X} = \sqrt{17}$	[**17**]
8. $\mathbf{SIN}(125^o)\sqrt{X} = (5.4 + 3.4)^2$	[**8937**]
9. $\sqrt{X} = \mathbf{LOG}(6754)$	[**14.67**]
10. $\sqrt{X} = \mathbf{SIN}^2(65^o) + \mathbf{COS}^2(65^o)$	[**1**]

A8ES

$A\sqrt{X} = B$ This is an easy non-Linear Equation

Answers:[ ]

1. $\sqrt{X} = 9$ [**X = 81**]
2. $\sqrt{X} = 3/4$ [**X = 9/16**]
3. $2.5\sqrt{X} = 10$ [**X = 16**]
4. $\sqrt{X} = \text{COS}(30°)$ [**X = 0.75**]
5. $\sqrt{X} = \sqrt{225}$ [**X = 225**]
6. $\sqrt{X} = \text{COS}(75°)/\text{LOG}(25)$ [**X = 0.0343**]
7. $\sqrt{X} = \text{COS}(45°) + \text{SIN}(45°)$ [**X = 2**]
8. $(\sqrt{X})^2 = (30.25)^2$ [**X = 915.0625**]
9. $\sqrt{X} = [\text{COS}(12.5°) + \text{TAN}(12.5°)]/\text{SIN}(12.5°)$ [**X = 30.636**]
10. $\sqrt{25}\sqrt{X} = 2000$ [**X = 160000**]
11. $\sqrt{(16X)} = 24$ **HINT: $\sqrt{(16X)} = \sqrt{16}\sqrt{X}$** [**X = 36**]
12. $\text{SIN}(87°)\sqrt{25X} = \text{LOG}(63)$ [**X = 0.3604**]

INTRODUCTION TO GEOMETRY

The Foundation Course is dedicated to your learning how to solve practical math problems that arise in a wide variety of industrial and "real world" situations.

In addition to learning how to use the power tool called a scientific calculator, you need to learn material from three fields, Algebra, Geometry and Trigonometry.

Geometry is the "Centerpiece" of math that you will use in most problems. It is all about physical space in one, two, and three dimensions: Lines, Flat Surfaces and 3-D objects.

Algebra is a tool that is often used along with Geometry to solve problems.

You use Geometry to set up an equation which you then solve for the unknown. The unknown might be a length, or some dimension you need to know, or area, or volume.

Trigonometry is a special subject used for triangles. There are occasions where you cannot solve a problem with just algebra and geometry alone and where you need trigonometry. It deals with triangles.

Geometry is one of humankind's oldest mathematical subjects along with numbers and algebra.

Geometry is the foundation of modern science and technology and much modern mathematics.

Mathematics is like a "contact" sport, or a game.

You learn by practicing and "doing."

Each Lesson will include a video discussion of the topic just as we did in Algebra.

Then you will be given Homework Problems to work.

You are encouraged to make up your own problems.

The more you "play" and the more questions you ask, the better you will learn.

When you think you are ready, take the Online Quiz.

This will give you an indicator if you have mastered the material. If not, go back and "play" some more.

Learning math is like climbing a ladder. If you do it one small step at a time, it is pretty easy. But, it is difficult to go from rung 4 to rung 9 directly.

This Foundation course has been designed to let you climb the ladder of math understanding in small steps.

But, **YOU** must do the climbing. Watching someone else climb isn't enough. Play the game.

G1 LESSON: WHAT IS GEOMETRY?

Mathematics is based on two fundamental concepts:

Numbers and Geometry

Numbers are used to count and measure things.

Geometry is used to model physical things.

There are actually several different kinds of geometry.

We will study the oldest of all geometries, **Euclidean**.

Euclidean Geometry is used in most practical situations.

We will study:

Points: 0 dimensional
Lines: 1 dimensional
Surface Objects: 2 dimensions
And: 3-D objects

We will learn how to analyze many geometric situations and then set up **Equations** to find the value of various unknowns. This could be how long something is, or how much area something is, or the volume of something.

Many of the practical problems one comes across in many walks of life involve some type of geometric object.

Historically, in our schools, emphasis has been placed on proving theorems (statements about geometric objects) with rigorous logic and step by step deductions.

This can be difficult and tedious, and sometimes seemingly meaningless. We will emphasis sound reasoning in the Foundation Course, but not formal "proofs."

G1E

WHAT IS GEOMETRY?

1. Math is based on what two fundamental concepts?

2. Numbers are used to?

3. **Geometry** is used to?

4. The oldest kind of **Geometry** is?

5. In **Geometry** we will study what four things?

6. What will we use to find unknowns in **Geometry**?

7. What kind of **Unknowns** might we wish to find?

G1EA

WHAT IS GEOMETRY? Answers: []

1. Math is based on what two fundamental concepts?

   [**Numbers and Geometry**]

2. Numbers are used to? [**Count and measure things**]

3. Geometry is used to? [**Model physical things**]

4. The oldest kind of geometry is? [**Euclidean**]

5. In Geometry we will study what four things?

   [**Points: 0 dimensional**]
   [**Lines: 1 dimension**]
   [**Surface Objects: 2 dimensions**]
   [**And: 3-D objects**]

6. What will we use to find Unknowns in Geometry?

   [**Equations and Algebra**]

7. What kind of Unknowns might we wish to find?

[**This could be how long something is, or how much area something is, or the volume of something.**]

Many of the practical problems one comes across in many walks of life involve some type of geometric object.

G2 LESSON: STRAIGHT LINES AND ANGLES

A **Point** is ideally a location in space with no length or width. It has zero area.

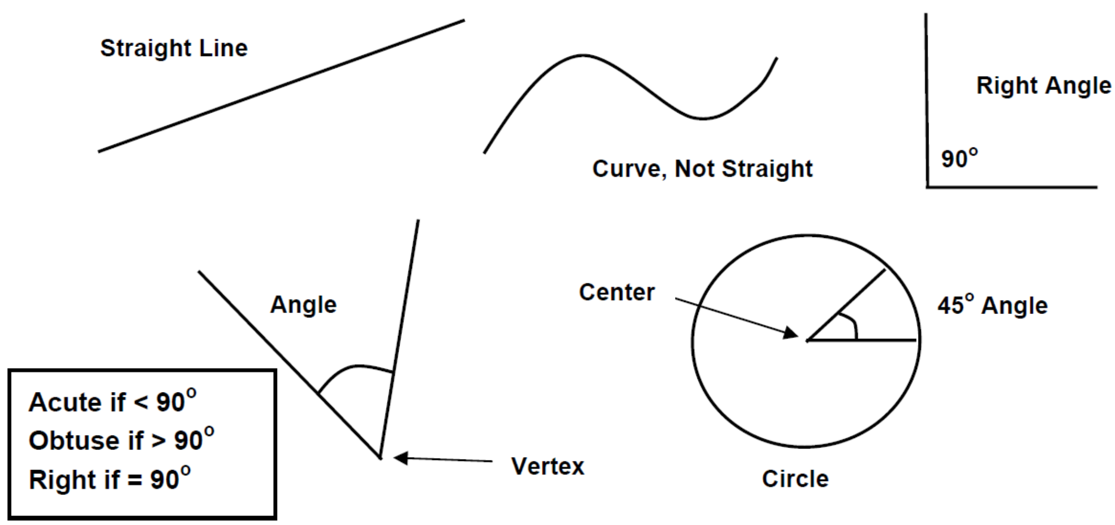
A **Plane** is a flat surface consisting of points. Think of a wall or blackboard as a plane. It is a surface with zero curvature.

A **Straight Line** (Segment) is the collection of points between two points that represents the shortest distance between them. It too has zero curvature. A **Straight Line** can be extended indefinitely.

The intersection of two lines (**straight**, unless I otherwise state), forms an **Angle** and their point of intersection is called the **Vertex**.

Angles are measured in **Degrees** (°) where there are 360° in a complete circle, a set of points equidistant from a point, center.

A **Right Angle** measures 90° and the two sides are **Perpendicular**.



G2E

STRAIGHT LINES AND ANGLES

1. What are: Point, Plane, and Straight Line?

2. What are an Angle and a Vertex?

3. How are Angles measured?

4. What is a Right Angle?

5. What are Acute and Obtuse Angles?

G2EA

STRAIGHT LINES AND ANGLES Answers: []

1. What are: Point, Plane, and Straight Line?

   [**A Point is ideally a location in space with no length or width. It has zero area.**

   A Plane is a flat surface consisting of points. Think of a wall or blackboard as a plane. It is a surface with zero curvature.

   A Straight Line (Segment) is the collection of points between two points that represents the shortest distance between them.]

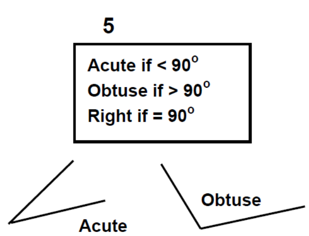
2. What are an Angle and a Vertex?

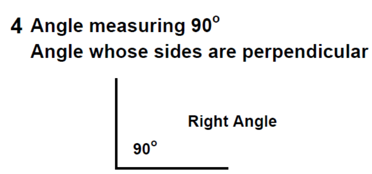
   [The intersection of two lines (straight, unless I otherwise state), forms an Angle and their point of intersection is called the Vertex.]

3. How are Angles measured?

   [Angles are measured in Degrees (o) where there are 360o in a complete circle, a set of points equidistant from a point, center.]

4. What is a Right Angle? [**See Below Right**]
5. What are Acute and Obtuse Angles? [**See Below Left**]





G3 LESSON: PARALLEL LINES

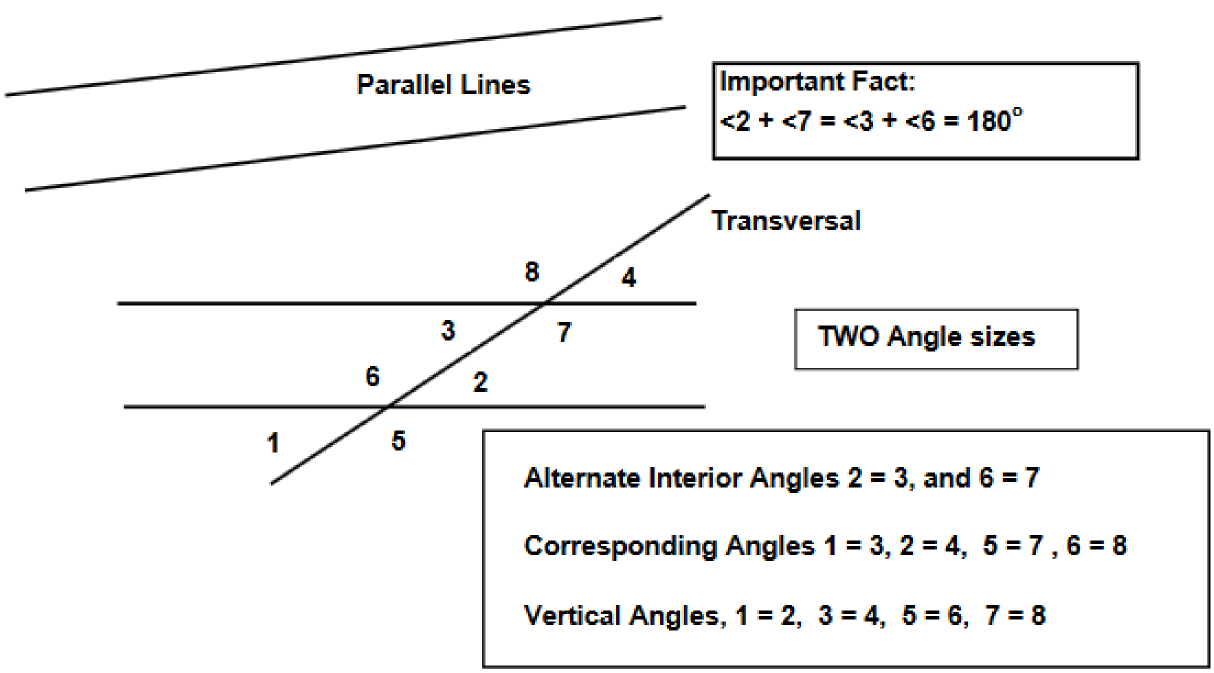
Two straight lines are **parallel** if they never intersect no matter how far they are extended in either direction.

The Fundamental Property in **Euclidean** Geometry is:

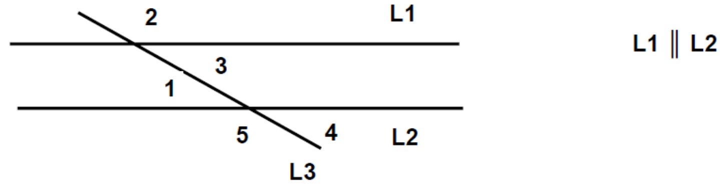
Given a straight line and an external point, there is exactly one straight line through this point parallel to the given line.

This is called the **Parallel Postulate** and it is not true for other **non-Euclidean** geometries.

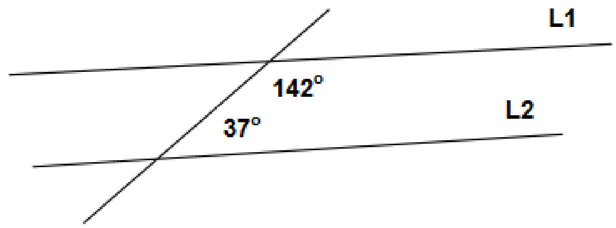
When two parallel lines are crossed by another straight line, called a **transversal**, eight angles are created in two sets of four equal-sized angles. This is a critical property.



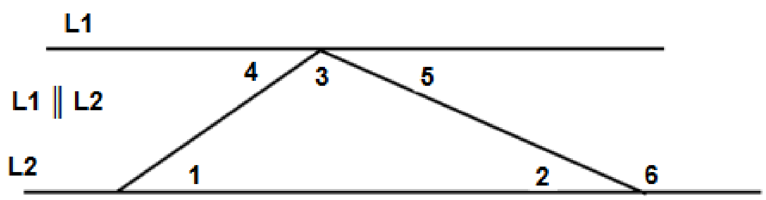
G3 Problems for Parallel Lines



1. Given <1=42^{o}, what are the sizes of <2 and <3?
2. Given <3=50^{o}, what are the sizes of <4 and <5?
3. Given <2=132^{o}, what are the sizes of <1 and <4?



4. Are L1 and L2 parallel?
5. What is the sum of two interior angles if the lines are parallel?

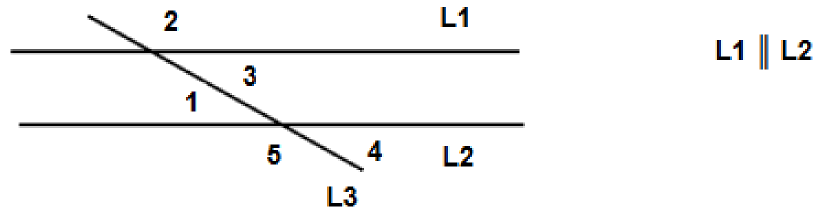


6. What is <4 + <3 +<5 =?
7. Which of the angles are equal <1, <2, <3, <4, <5=?
8. What is <1 + <2 + <3=?
9. If <1 = 43^{o} and <3 = 102^{o} then what does <6=?
10. In problem #9, what does <2=?

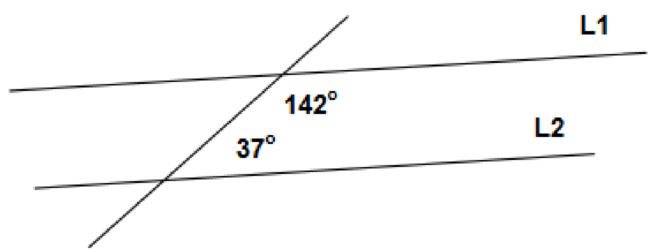
ANSWERS

1. <2 = 138^{o} and <3 = 42^{o}
2. <4 = 50^{o} and <5 = 130^{o}
3. <1 = <4 = 48^{o}
4. No
5. 180^{o}
6. 180^{o}
7. <1 = <4 and <2 = <5
8. 180^{o}
9. 43^{o} + 102^{o} = 145^{o}
10. 180^{o} -145^{o} = 35^{o}

PARALLEL LINES

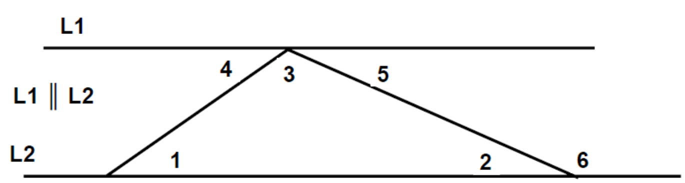


1. Given <1 = 38°, what are the sizes of <2 and <3?
2. Given <3 = 54°, what are sizes of <4 and <5?
3. Given <2 = 138°, what are sizes of <1 and <4?
4. Given:



Are L1 and L2 Parallel?

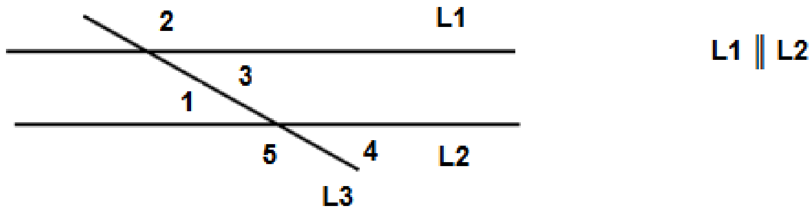
5. What is the sum of two opposite interior angles if the lines are parallel?



6. What is <4 + <3 + <5 =?
7. Which of these angles are equal <1, <2, <3, <4, <5?
8. What is <1 + <2 + <3 =?
9. If <1 = 42° and <3 = 105°, what does <6 =?
10. In problem #9, what does <2 =?
11. The sum of the three angles of a triangle equal?

G3EA

PARALLEL LINES Answers: []



1. Given <1 = 38°, what are the sizes of <2 and <3?

   [**<2 = 142° and <3 = 38°**]

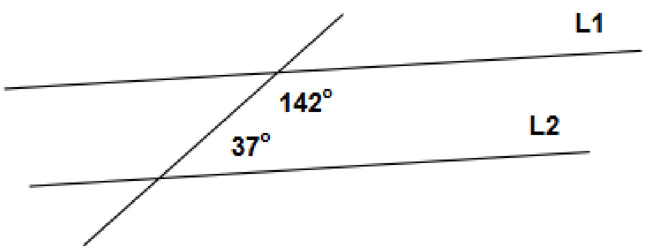
2. Given <3 = 54°, what are sizes of <4 and <5?

   [**<4 = 54° and <5 = 126°**]

3. Given <2 = 138°, what are sizes of <1 and <4?

   [**<1 = 42° and <5 = 138°**]

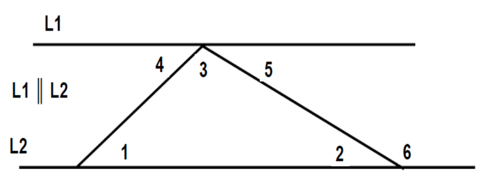
4. Given:



   Are L1 and L2 Parallel? [**NO because: 142 + 37 = 179 not 80**]

5. What is the sum of two interior angles if the lines are parallel?

   [**<5 + <6 = 180°**]



6. What is <4 + <3 + <5 =? [**180°**]

7. Which of these angles are equal <1, <2, <3, <4, <5?

   [**<1 = <4**]

G3 EA (cont’d)

PARALLEL LINES (cont’d)   Answers: []

8. What is <1 + <2 + <3 =?   [180°]

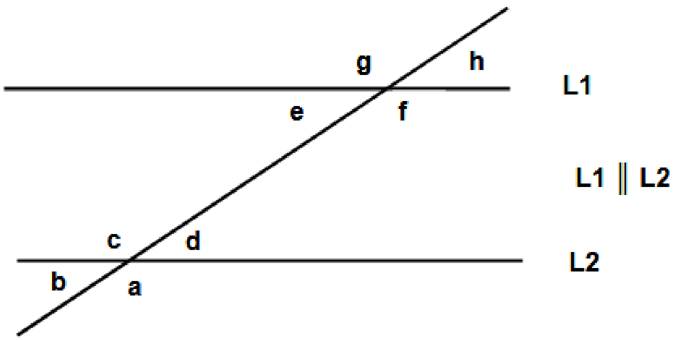
9. If <1 = 42° and <3 = 105°, what does <6 =?   [**147°**]

10. In problem #9, what does <2 =?   [**33°**]

11. The sum of the three angles of a triangle equal?   [**180°**]

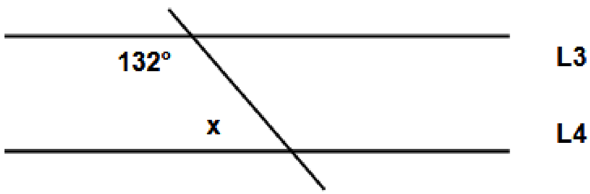
G3ES

PARALLEL LINES



1.) How many angles do you need to know in order to replace the letters in the diagram to the left?

2.) If <a = 115, find the rest of the remaining angles.

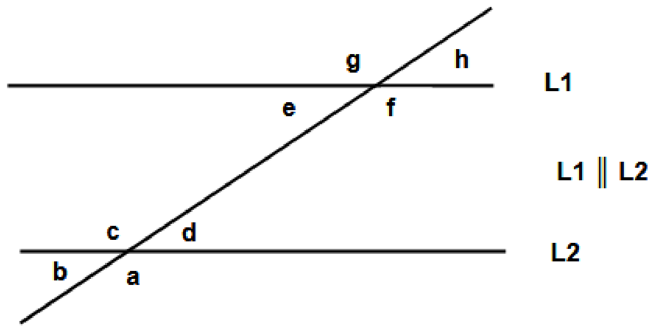


3.) If L3 and L4 are parallel, what must <x equal?

4.) If two lines are truly parallel, what will they never do?
Hint: Think about intersecting lines

G3ESA

PARALLEL LINES

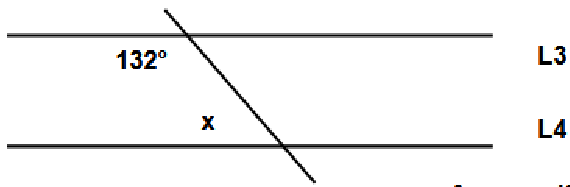


1.) How many angles do you need to know in order to replace the letters in the diagram to the left?

Answer: Only 1 angle.

2.) If <a = 115, find the rest of the remaining angles.

Answer: <b = <d = <e = <h = 65°, <a = <c = <f = <g = 115°



3.) If L3 and L4 are parallel, what must <x equal?

Answer: If L3 and L4 are parallel, <x and 132° must add up to 180°, therefore <x = 180 - 132 = 48°

4.) If two lines are truly parallel, what will they never do?
Hint: Think about intersecting lines

Answer: Two parallel lines will never touch.

G4 LESSON: TRIANGLES, DEFINITION, SUM OF ANGLES

A Triangle is a three-sided **polygon**, i.e., a geometric figure created by three intersecting straight lines. Thus, a triangle has three sides and three vertices.

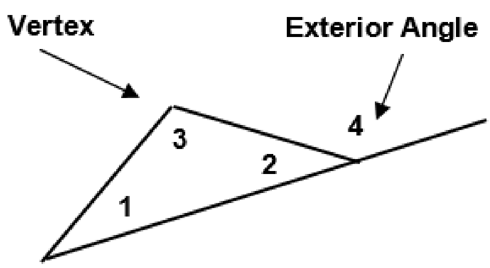
The sum of the three interior angles of a triangle is always 180^o.
Exterior Angle = Sum of opposite Interiors

$1 + 2 + 3 = 180^o$ and $4 = 1 + 3$

Triangles are often used to model a physical situation.

There are several types of triangles:

Right, Acute, Obtuse, Isosceles, and Equilateral. See below.



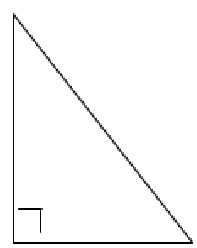
<1 + <2 + <3 = 180°

<4 = <1 + <3

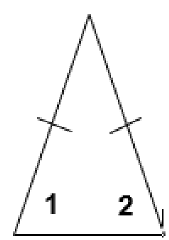
Acute **All angles < 90°**

Obtuse **One angle > 90°**

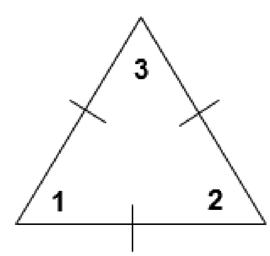
Right **One angle = 90°**



Right Triangle



Isosceles Triangle
<1 = <2
Two Equal Sides



Equilateral Triangle
<1 = <2 = <3 = 60°

Three Equal Sides

G4 Triangle Problems

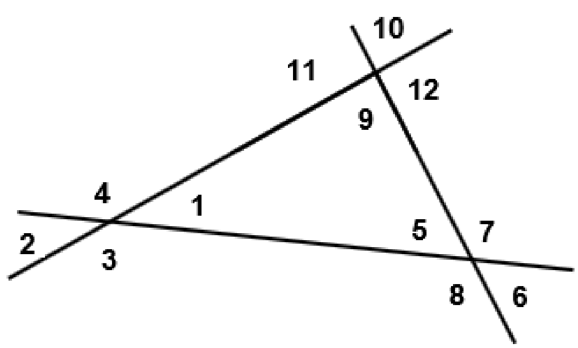
Finding unknown angles from known angles.

Each **vertex** of a triangle has four angles associated with it for a total of twelve angles for a triangle. There will be six values.

If you know any two angles from two different vertices, then you can calculate all the other angles.

This is demonstrated below.

Note 1: Angles do not have the < symbol



$1 + 5 + 9 = 180^\circ$

$4 = 3 = 180^\circ - 1$ $2 = 1$

$7 = 8 = 180^\circ - 5$ $6 = 5$

$11 = 12 = 180^\circ - 9$ $10 = 9$

Given any two angles from two vertices, we can calculate all the other angles.

Example 1 $1 = 40^\circ$ and $7 = 120^\circ$ Find the other angles

Answers

$5 = 6 = 180^\circ - 120^\circ = 60^\circ$ $8 = 120^\circ$

$4 = 3 = 180^\circ - 40^\circ$ $2 = 40^\circ$

** $9 = 10 = 180^\circ - 1 - 5 = 180^\circ - 40^\circ - 60^\circ = 80^\circ$

$11 = 12 = 180^\circ - 80^\circ = 100^\circ$

Example 2 $9 = 75^\circ$ and $8 = 110^\circ$ Find other angles

Answers

$5 = 6 = 180^\circ - 110^\circ = 70^\circ$ and $7 = 110^\circ$

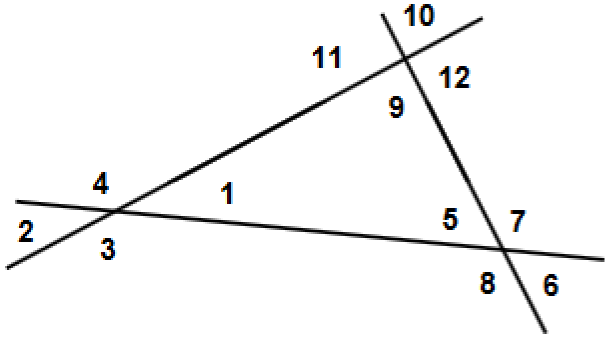
$11 = 12 = 180^\circ - 75^\circ = 105^\circ$ and $10 = 75^\circ$

** $2 = 1 = 180^\circ - 75^\circ - 70^\circ = 35^\circ$ and $4 = 3 = 180^\circ - 35^\circ = 145^\circ$

G4E

TRIANGLES

Find the unknown angles from known angles below.



$1 + 5 + 9 = 180^\circ$

$4 = 3 = 180^\circ - 1$ $\quad 2 = 1$

$7 = 8 = 180^\circ - 5$ $\quad 6 = 5$

$11 = 12 = 180^\circ - 9$ $\quad 10 = 9$

Given any two angles from two vertices, we can calculate all the other angles.

Exercise 1: $1 = 40^\circ$ and $7 = 120^\circ$ **Find the other angles.**

Exercise 2: $9 = 75^\circ$ and $8 = 110^\circ$ **Find the other angles.**

Exercise 3: $2 = 38^\circ$ and $10 = 70^\circ$ **Find the other angles.**

Exercise 4: $9 = 72^\circ$ and $6 = 68^\circ$ **Find the other angles.**

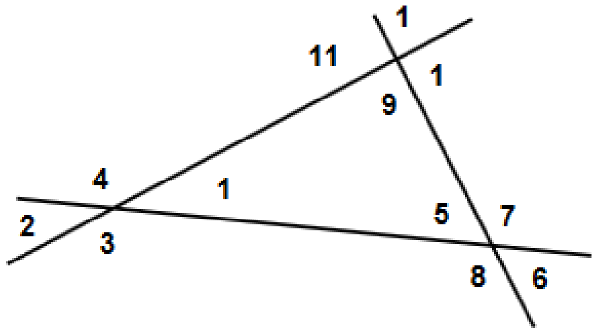
Exercise 5: $4 = 135^\circ$ and $7 = 118^\circ$ **Find the other angles.**

Exercise 6: $10 = 85^\circ$ and $12 = 95^\circ$ **Find the other angles.**

G4EA

TRIANGLES

Find the unknown angles from known angles below.



$1 + 5 + 9 = 180^\circ$

$4 = 3 = 180^\circ - 1$ $2 = 1$

$7 = 8 = 180^\circ - 5$ $6 = 5$

$11 = 12 = 180^\circ - 9$ $10 = 9$

Given any two angles from two vertices, we can calculate all the other angles.

Exercise 1 $1 = 40^\circ$ and $7 = 120^\circ$ **Find the other angles**

Answers
$5 = 6 = 180^\circ - 120^\circ = 60^\circ$ $8 = 120^\circ$
$4 = 3 = 180^\circ - 40^\circ = 140^\circ$ $2 = 40^\circ$
$11 = 12 = 180^\circ - 80^\circ = 100^\circ$ $9 = 10 = 80^\circ$

Exercise 2 $9 = 75^\circ$ and $8 = 110^\circ$ **Find other angles**

Answers
$5 = 6 = 180^\circ - 110^\circ = 70^\circ$ and $7 = 110^\circ$
$11 = 12 = 180^\circ - 75^\circ = 105^\circ$ and $10 = 75^\circ$
$2 = 1 = 180^\circ - 75^\circ - 70^\circ = 35^\circ$ and $4 = 3 = 180^\circ - 35^\circ = 145^\circ$

Exercise 3 $2 = 38^\circ$ and $10 = 70^\circ$ **Find the other angles**

Answers
$1 = 38^\circ$ and $3 = 4 = 142^\circ$
$9 = 70^\circ$ and $11 = 12 = 110^\circ$
$5 = 6 = 72^\circ$ and $7 = 8 = 108^\circ$

Exercise 4 $9 = 72^\circ$ and $6 = 68^\circ$ **Find the other angles**

Answers
$5 = 6 = 68^\circ$ and $7 = 8 = 112^\circ$
$11 = 12 = 108^\circ$ and $10 = 72^\circ$
$2 = 1 = 40^\circ$ and $4 = 3 = 140^\circ$

Exercise 5 $4 = 135^\circ$ and $7 = 118^\circ$ **Find the other angles**

Answers
$5 = 6 = 62^\circ$ and $7 = 8 = 118^\circ$
$11 = 12 = 107^\circ$ and $9 = 10 = 73^\circ$
$2 = 1 = 45^\circ$ and $4 = 3 = 135^\circ$

Exercise 6 $10 = 85^\circ$ and $12 = 95^\circ$ **Find the other angles**

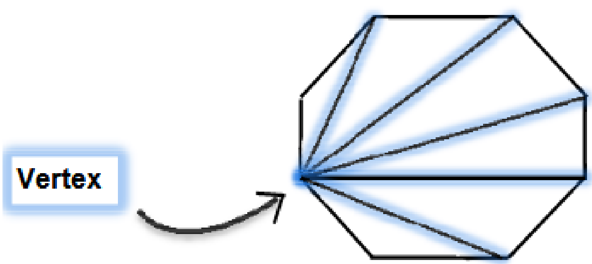
Answers
$9 = 85^\circ$ and $11 = 95^\circ$
Not enough information for the other angles.

G4ES

TRIANGLES

Note: The interior angles of any polygon add up to the number of sides the shape has - 2 and then multiplied by 180.

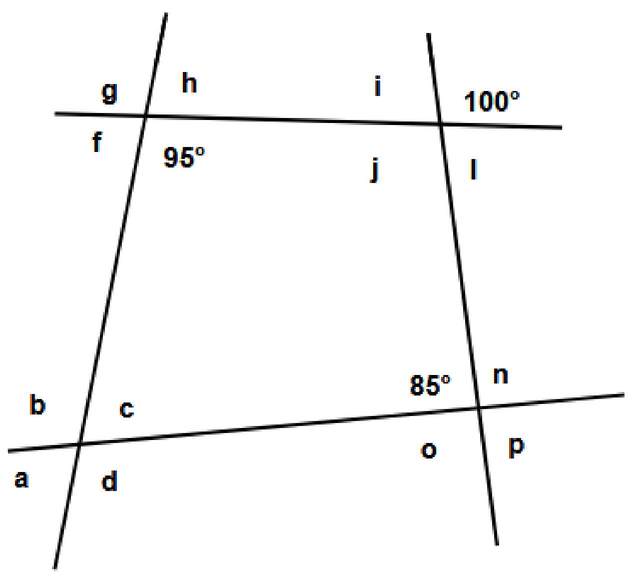
Ex. Triangles have 3 sides --> (3 - 2) times 180 = 180°
Ex. Rectangles have 4 sides --> (4 - 2) times 180 = 360°



1.) The reasoning behind this trick all comes back to triangles. How many degrees does a triangle's interior angles add up to?

2.) Now how many triangles can we break up this octagon into from a single vertex?

****Note: A vertex is just a corner made by two lines!****



3.) With the help of this trick, find the remaining angles in the diagram to the left.

G4ESA

TRIANGLES

Note: The interior angles of any polygon add up to the number of sides the shape has - 2 and then multiplied by 180.

Ex. Triangles have 3 sides --> (3 - 2) times 180 = 180°
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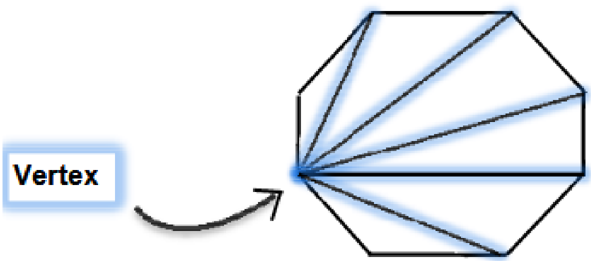


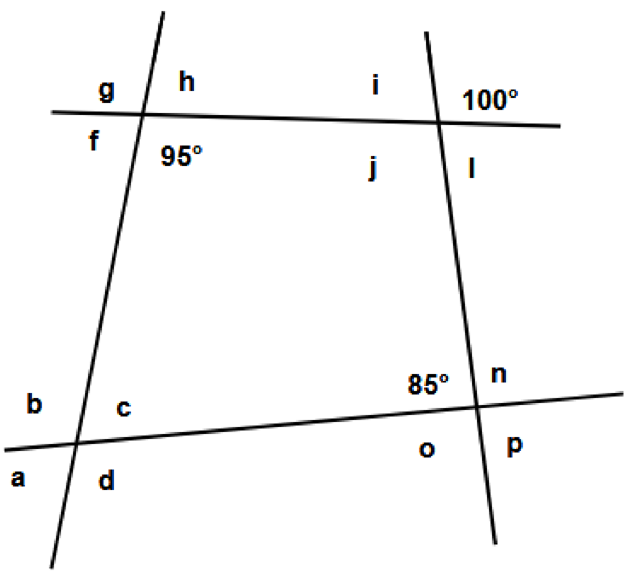
1.) The reasoning behind this trick all comes back to triangles. How many degrees does a triangle's interior angles add up to?

Answer: 180°

2.) Now how many triangles can we break up this octagon into from a single vertex?

****Note: A vertex is just a corner made by two lines!****

Answer: 6 triangles



3.) With the help of this trick, find the remaining angles in the diagram to the left.

Answer:
a = c = 80°
b = d = 100°
f = h = 85°
g = 95°
i = l = 80°
j = 100°
n = o = 95°
p = 85°

G5 LESSON: RIGHT TRIANGLES - PYTHAGOREAN THEOREM

A **Right Triangle** has one of its angles = 90°

The side opposite the **right angle** is called the **Hypotenuse.**

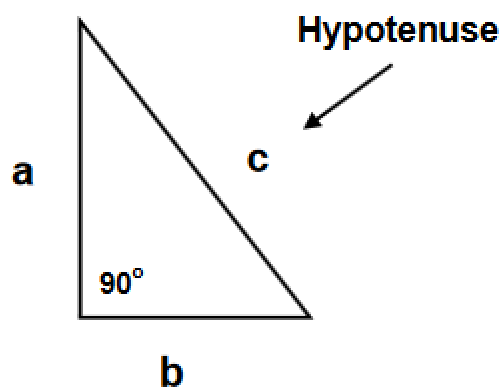
The sum of the **other two angles** will sum to 90°

The Lengths of the three sides of a **Right Triangle** are related by the **Pythagorean Theorem.**

If, they are **a**, **b**, and **C** where "**C**" is the **hypotenuse**, then:

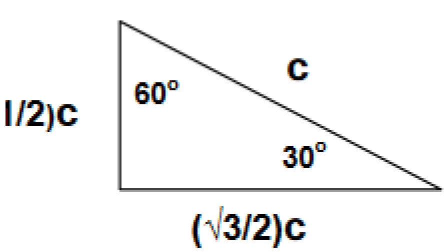
$$a^2 + b^2 = c^2$$

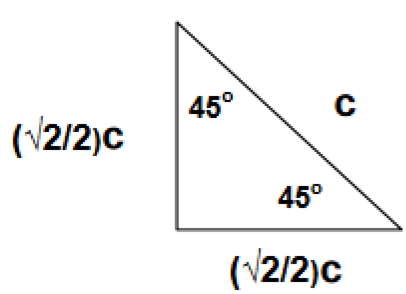
So, $c = \sqrt{a^2 + b^2}$; $b = \sqrt{c^2 - a^2}$; $a = \sqrt{c^2 - b^2}$



Pythogorean Theorem

$$a^2 + b^2 = c^2$$

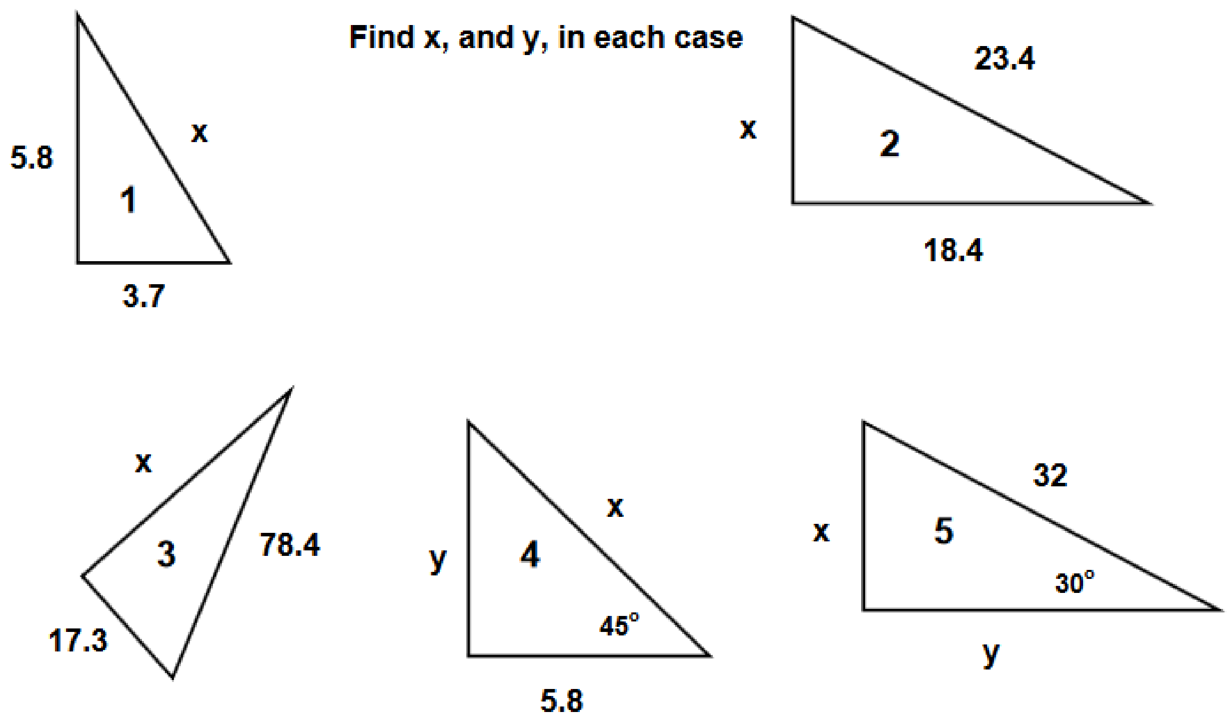




G5 Right Triangle Problems

Typically, you are given one or two sides or angles and want to figure out the other sides or angles.

Here are a few examples (You will typically use the **Pythagorean Theorem** and a calculator):



Answers 1. x = 6.9 2. x = 14.5 3. 76.5 4. y = 5.8, x = 8.2 5. x = 16, y = 27.7

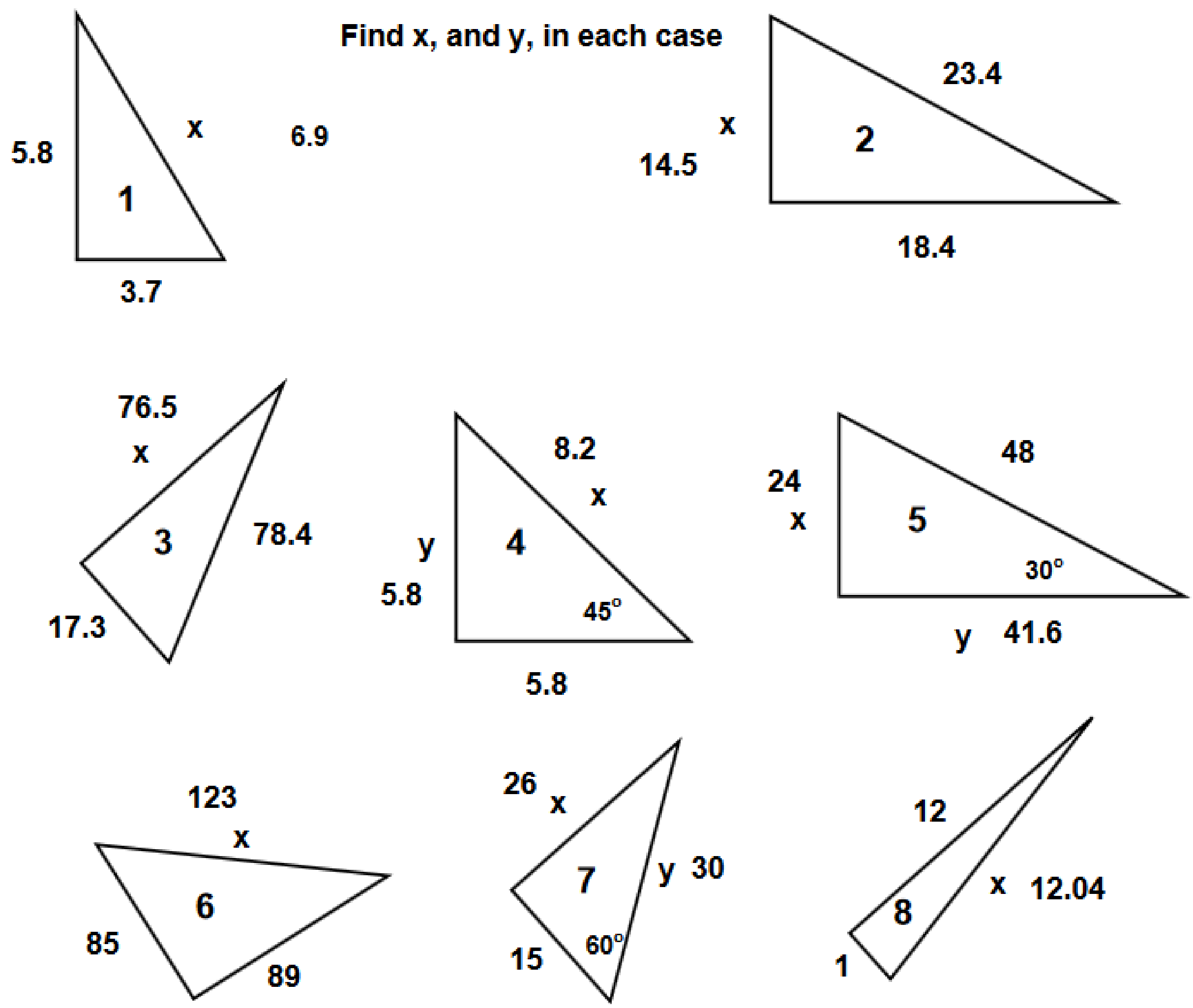
G5E

RIGHT TRIANGLES

Find **x** and **y** in each of the Exercises below.

You will typically use the **Pythagorean Theorem** and a calculator.

All triangles below are **right triangles**.



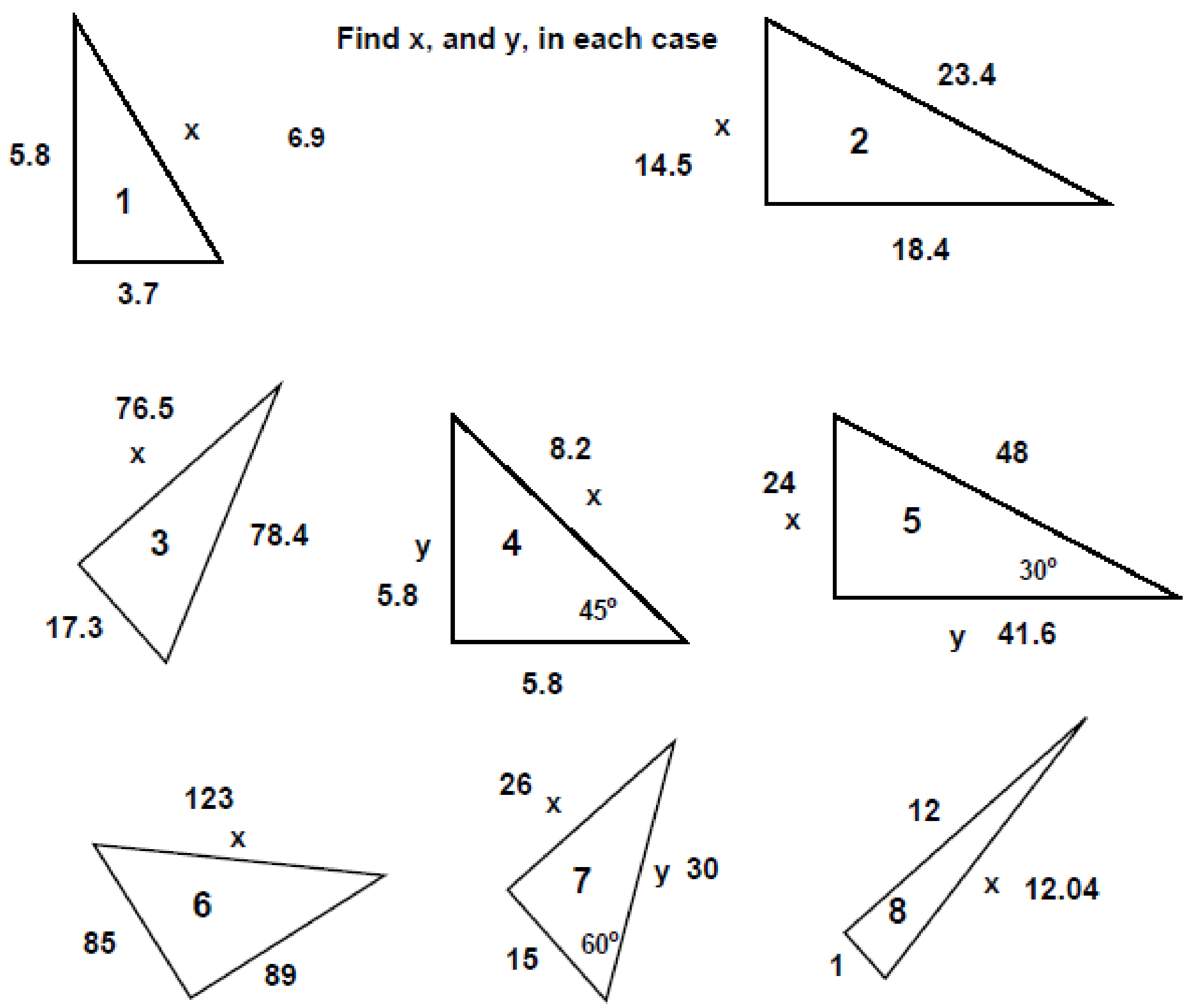
G5EA

RIGHT TRIANGLES

Find **x** and **y** in each of the Exercises below.

You will typically use the **Pythagorean Theorem** and a calculator.

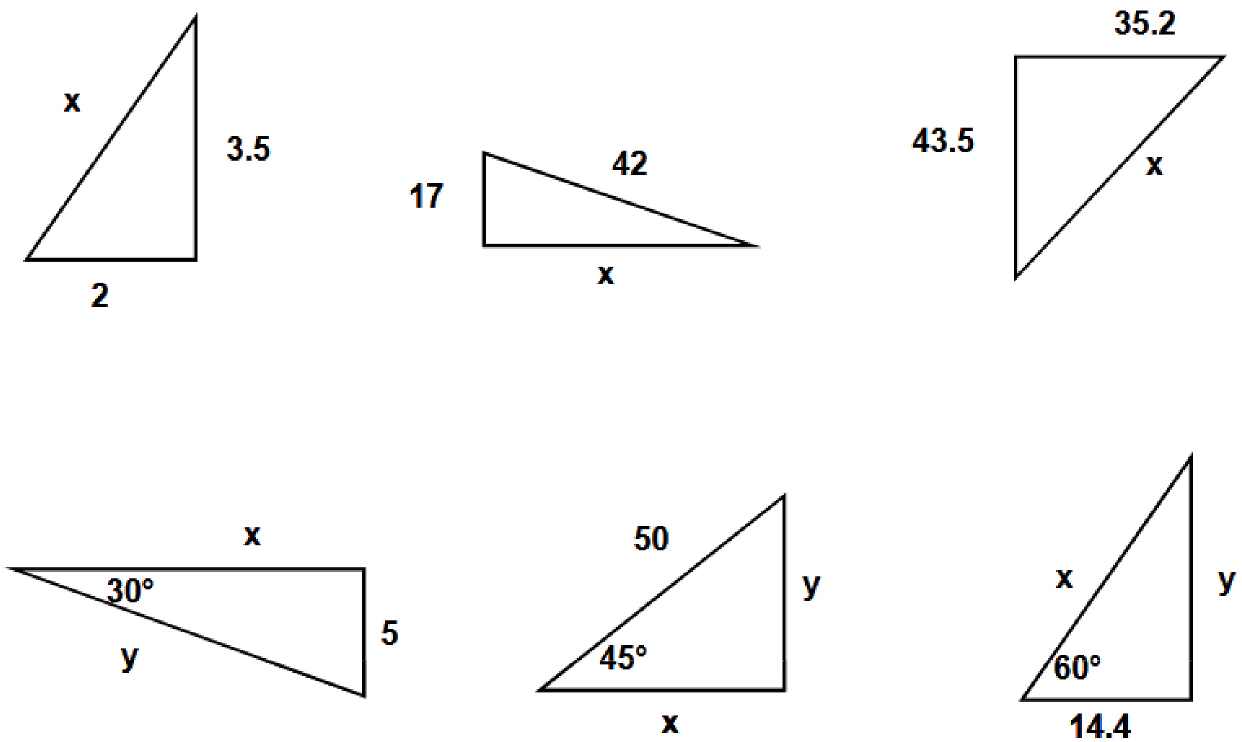
All triangles below are **right triangles**.



G5ES

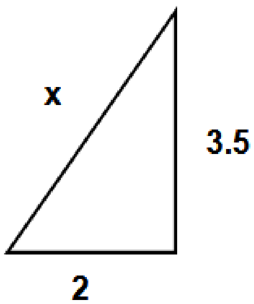
RIGHT TRIANGLES

Find the unknowns, x and y.

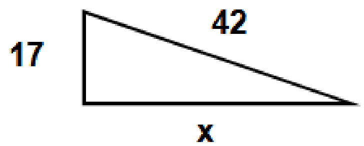


G5ESA

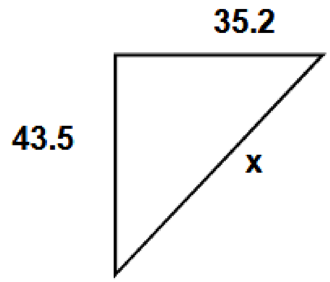
RIGHT TRIANGLES



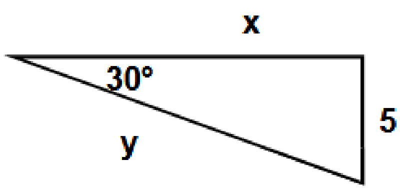
x = 4.03



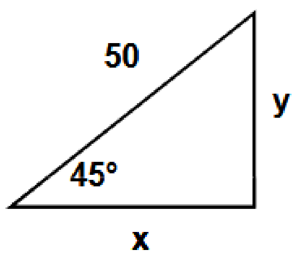
x = 38.41



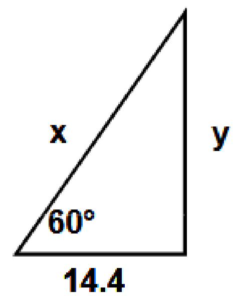
x = 55.95



x = 8.66, y = 10



x = 35.36, y = 35.36



x = 28.8, y = 24.94

G6 LESSON: SIMILAR TRIANGLES

Two Triangles are similar if they have equal angles.

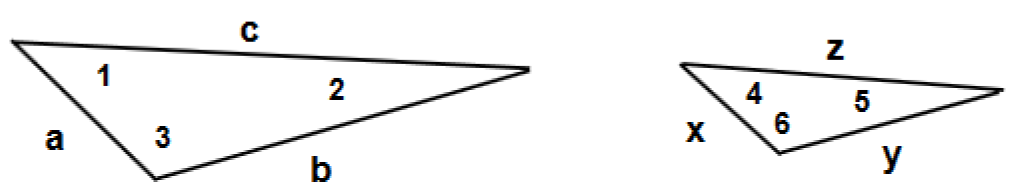
This means they have the same "**shape**" but may be of different sizes. If they also are the same size they are **congruent**.

Similar triangles appear frequently in practical problems.

Their corresponding ratios are equal, and that is what makes them so important and useful.

This is often the way you set up an **Equation** to find an **Unknown**.

Note: If **two** sets of angles are equal, the **third** must be equal also, and the triangles are similar.



Given: 1 = 4 ; 2 = 5 ; 3 = 6, Called corresponding angles

Corresponding sides are: a ↔ x ; b ↔ y ; c ↔ z

The Following Ratios are Equal

a/x = b/y = c/z and **x/a = y/b = z/c**

a/b = x/y	**a/c = x/z**	**b/c = y/z**
b/a = y/x	**c/a = z/x**	**c/b = z/y**

G6 Similar Triangles Problems

When you have **two equal ratios** with one **unknown** it is a simple algebra problem to solve for the unknown **X**.

X/a = b/c **and X** = a(b/c) **X**/3 = 7/12 **and X** = 3x(7/12) = 1.75

a/**X** = b/c **and X** = a(c/b) 3/**X** = 7/12 **and X** = 3x(12/7) = 5.15

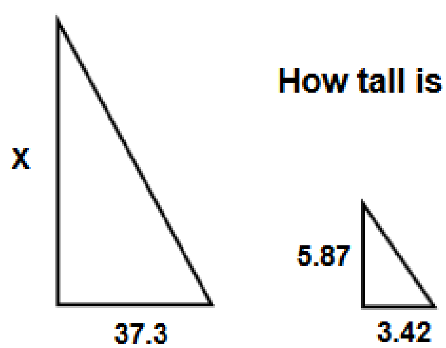
Find two similar triangles where the **unknown** is one side and you know three more sides, one of which is opposite the corresponding angle of the unknown.

Given: 1 = 4 ; 2 = 5 ; 3 = 6 Find x

x/ 12.3 = 3.7/5.4 so x = 12.3(3.7/5.4) = 8.4

or x/3.7 = 12.3/5.4 so x = 3.7(12.3/5.4) = 8.4

Wrong: x/3.7 = 5.4/12.3 See why?



How tall is the Pole? The horizontal lines are shadows

x/5.87 = 37.3/3.42

x = 5.87(37.3.3/3.42)

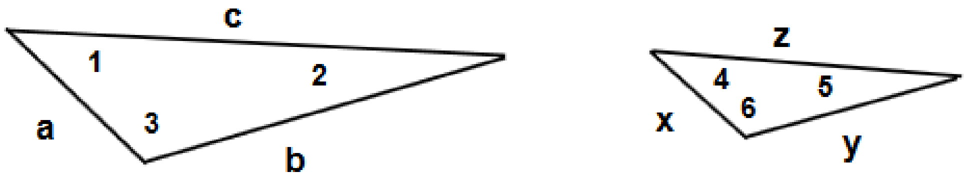
= 64.02 = 64.0

G6E

SIMILAR TRIANGLES

In each Exercise assume the triangles are similar.

Find lengths that you can.



Given: <1 = <4 and <2 = <5

1. What can you conclude about <3 and <6 and why?

2. What are the corresponding sides in pairs?

3. a = 12.3, b = 18.7, x = 5.4, y = ?, z = ?

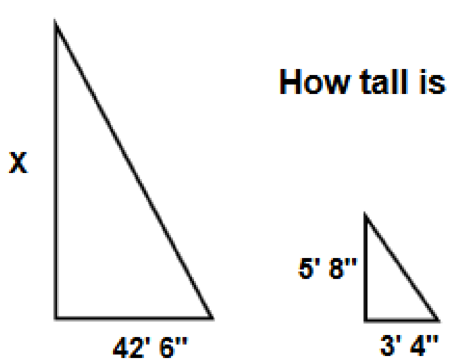
4. c = 1435, z = 765, y = 453, What can you figure?

5. a = .05, x = .02, y = .04, What can you figure?

6. c = 4, b = 3, x = 1.5, What can you figure?

7. b = 2 3/8, x = 3/4, y = 4/5, What can you figure?

8. In Drawing below, how tall is the pole?



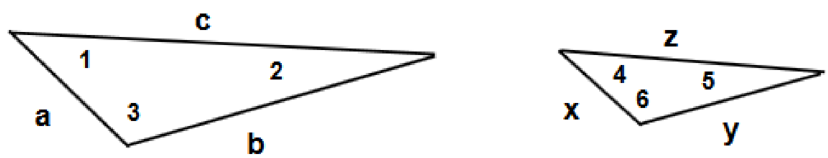
How tall is the Pole? The horizontal lines are shadows

Hint: 1" = 1/12', So, 5'8" = (5 8/12)'

G6EA

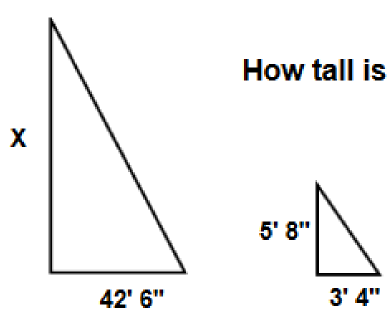
SIMILAR TRIANGLES   Answers: []

In each Exercise assume the triangles are similar. Find lengths that you can.



Given: <1 = <4 and <2 = <5

1. What can you conclude about <3 and <6 and why?
   [**They are equal due to sum of angles of triangle equals 180°**]
2. What are the corresponding sides in pairs?
   [**a ↔ x,   b ↔ y,   c ↔ z**]
3. a = 12.3,   b = 18.7,   x = 5.4,   y = ?,   z = ?
   [**y = 8.2   Have not yet learned how to calculate z**]
4. c = 1435,   z = 765,   y = 453   What can you figure?
   [**b = 850**]
5. a = 0.05,   x = 0.02,   y = 0.04   What can you figure?
   [**b = 0.1**]
6. c = 4,   b = 3,   x = 1.5   What can you figure?
   [**Nothing with just similar triangles**]
7. b = 2 3/8,   x = 3/4   y = 4/5,   What can you figure?
   [**a = 2 29/128 = 2.23**]
8. In drawing below, how tall is the pole?
   [**(72 1/4)' = 72' 3"**]



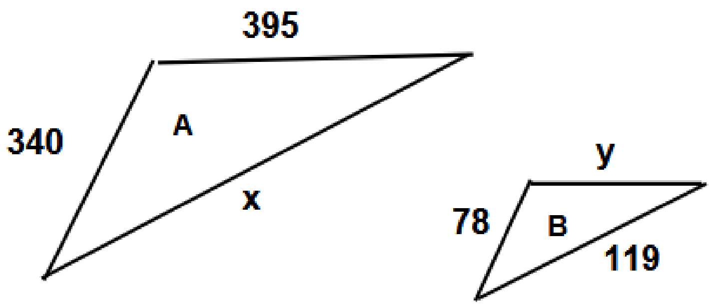
How tall is the Pole? The horizontal lines are shadows

Hint: 1" = 1/12', So, 5'8" = (58/12)'

G6ES

SIMILAR TRIANGLES

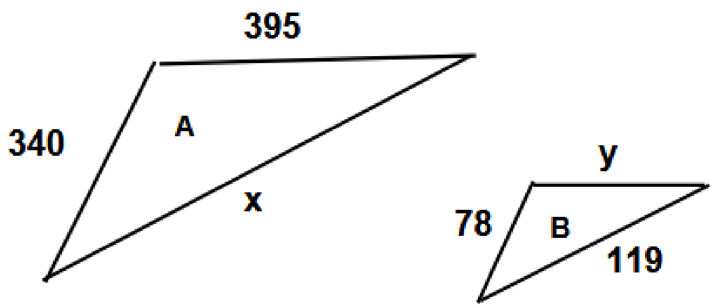
Find the unknowns, x and y.



Assume that the two triangles to the left are similar. Using this knowledge, find the unknown lengths.

G6ESA

SIMILAR TRIANGLES



Assume that the two triangles to the left are similar. Using this knowledge, find the unknown lengths.

x = 518.72, y = 90.62

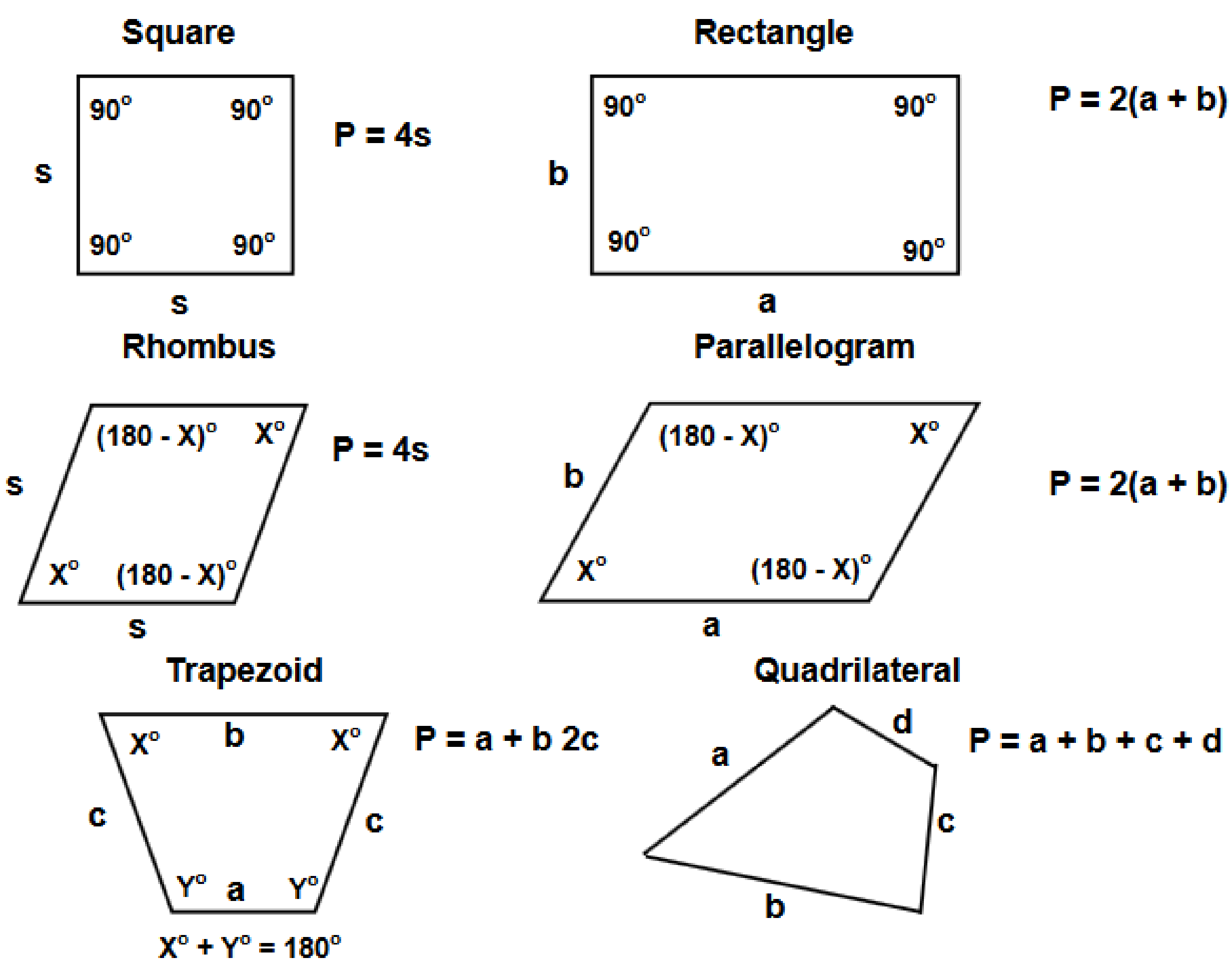
G7 LESSON: QUADRILATERALS, POLYGONS, PERIMETERS (P)

A **Polygon** is a closed geometric figure whose boundary is straight line segments. The **Perimeter** (**P**) is the distance around the polygon.

A **Quadrilateral** is a **polygon** with four sides.

Common **Quadrilaterals** are **Square**, **Rectangle**, **Rhombus**, **Parallelogram**, and **Trapezoid**.

There are three things one is usually interested in for any **quadrilateral**: **Dimensions**, **Perimeter** and **Area**.



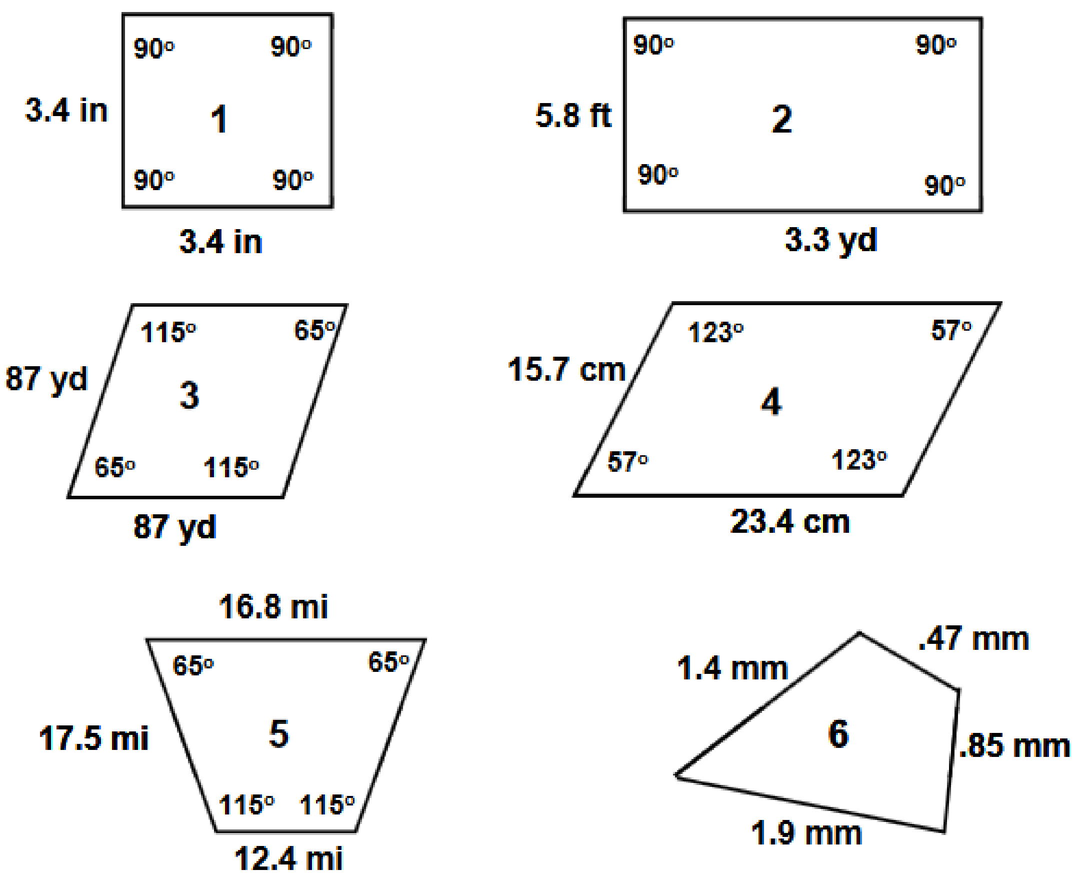
G7 Quadrilaterals, Polygons, Perimeters (P) Problems

Identify the figures below and compute their **Perimeters.**

Note: The Units of measure of the sides must be the same for all sides. For example, if one side is given in feet and the other side in inches, then you must convert one of the side's units accordingly. Must use same units for both sides.

Suppose a **rectangle** has one side 11/2 feet, and the other side 8 inches. Then, convert feet to inches or inches to feet.

Answers are at bottom of page - Number, name, Perimeter.



Answer: 1. Square 13.6 in 2. Rectangle 31.4 ft or 10.5 yd 3. Rhombus 348 yd

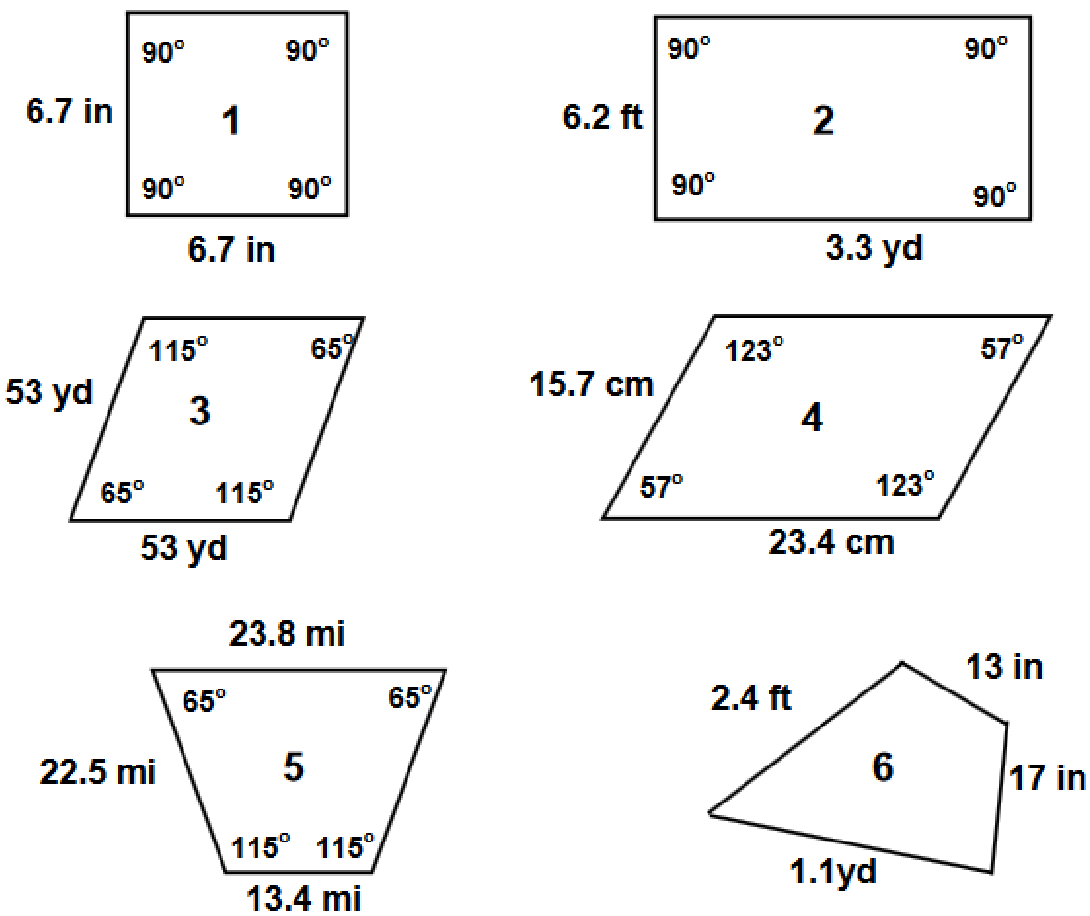
4. Parallelogram 78.2 cm 5. Trapezoid 64.2 mi 6. Quadrilateral 4.62 mm

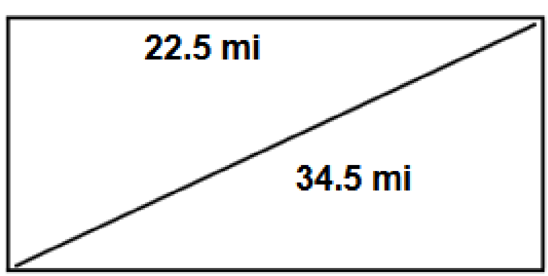
G7E

QUADRILATERALS, POLYGONS, PERIMETERS (P)

Identify the figures below and compute their Perimeters

Note: The Units of measure of the sides must be the same for all sides. For example, if one side is given in feet and the other side in inches, then you must convert one of the side's units accordingly. Must use same units for both sides.





Hint: Use Pythogorean Theorem first

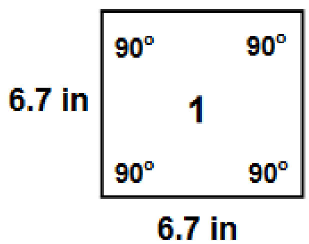
G7EA

QUADRILATERALS, POLYGONS, PERIMETERS (P)

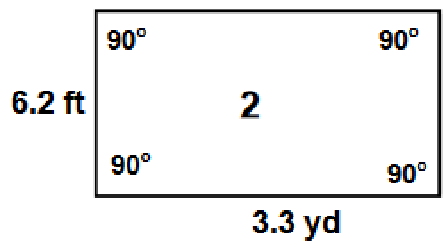
Identify the figures below and compute their Perimeters

Note: The Units of measure of the sides must be the same for all sides. For example, if one side is given in feet and the other side in inches, then you must convert one of the side's units accordingly. Must use same units for both sides.

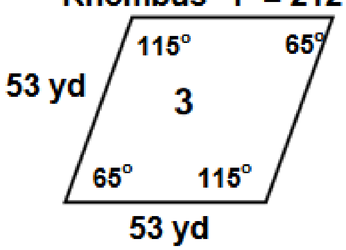
Square P = 26.8



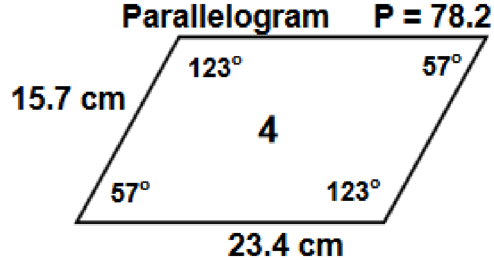
Rectangle P = 32.2 ft = 10.7 yd



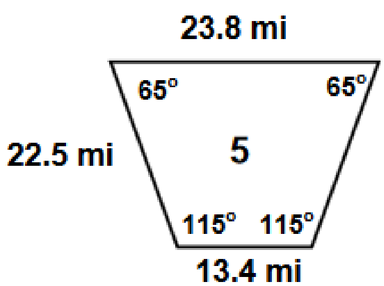
Rhombus P = 212 yd



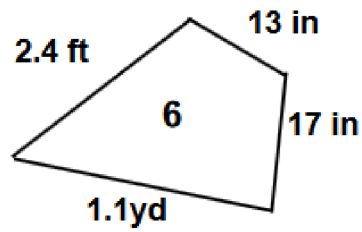
Parallelogram P = 78.2

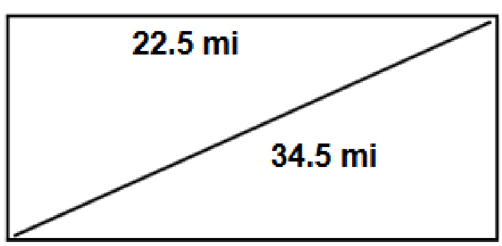


Trapezoid P = 82.2 mi



Polygon P = 98.4 in = 8.2 ft = 2.7 yd



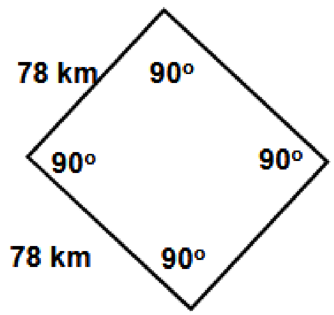


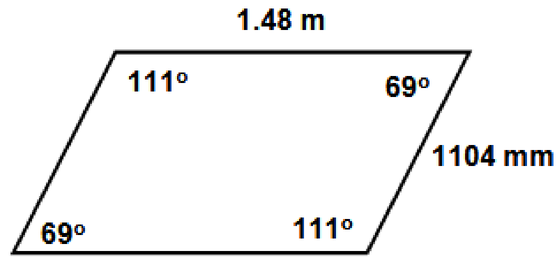
Rectangle P = 97.3 mi

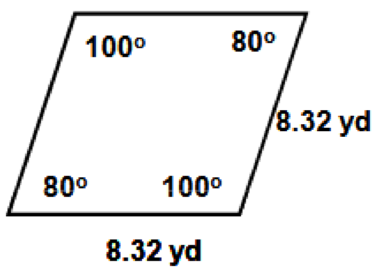
G7ES

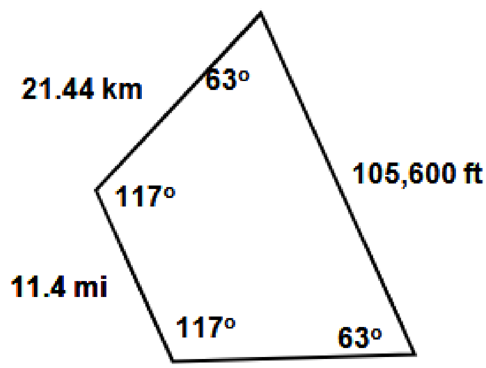
QUADRILATERALS, POLYGONS, PERIMETERS (P)

Identify the figures and calculate their perimeters. Be sure to check units and convert all numbers to the same unit where necessary.





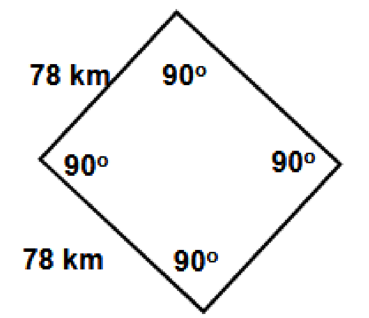




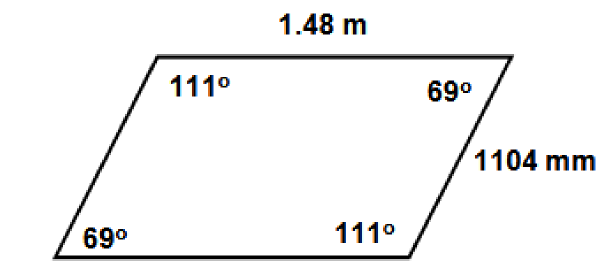
G7ESA

QUADRILATERALS, POLYGONS, PERIMETERS (P)

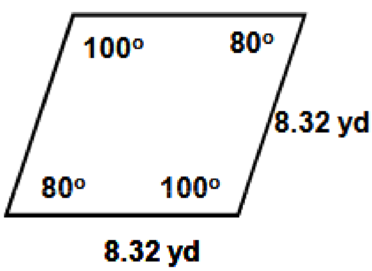
Identify the figures and calculate their perimeters. Be sure to check units and convert all numbers to the same unit where necessary.



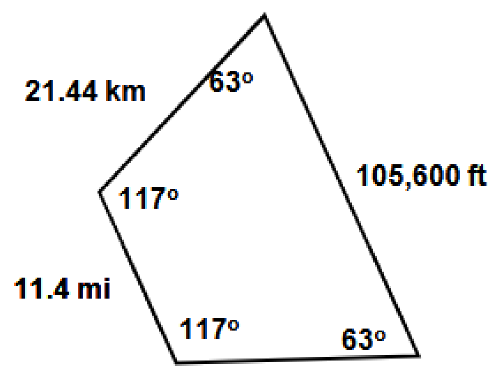
Square, P = 312 km



Parallelogram, P = 5.168 m = 5168mm



Rhombus, P = 33.28 yd



Trapezoid, P = 93.12 km = 58.2 mi = 307,296 ft

G8 LESSON: AREA OF TRIANGLES AND RECTANGLES

The **Area** of any **polygon** is a measure of its size.

The **Rectangle** is the simplest **polygon** and its **Area** is defined to be:

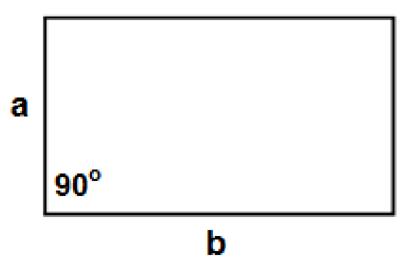
Area = ab where a and b are the lengths of its two sides.

A **Parallelogram** is a "**lopsided**" rectangle whose two adjacent sides have an angle **X°** instead of 90°.

Its **Area** can be calculated with a "**Correction Factor**" which is **SIN**(X°)

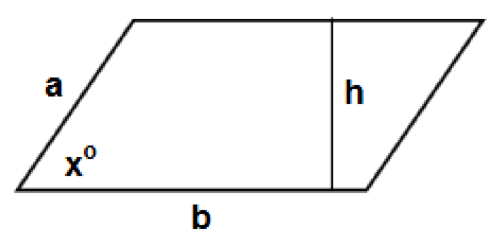
A **Triangle** is one-half of a **parallelogram**. So, its **Area** can be expressed with this same correction factor. **See Below.**

Of course, if one does know the "**height**" then one can use an alternative formula for the **Area**, which is usually given.

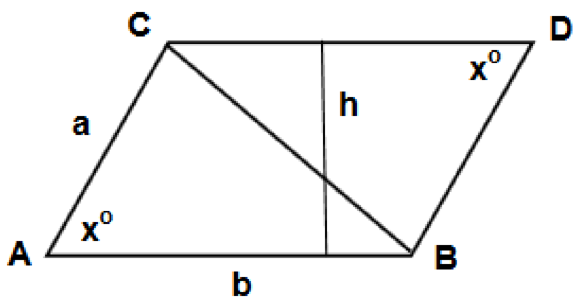


Area = ab

h = height



Area = abSIN(x°)
Area = hb



Triangle ABC = Triangle BDC

Area = .5abSIN(x°)

Area = (1/2)hb

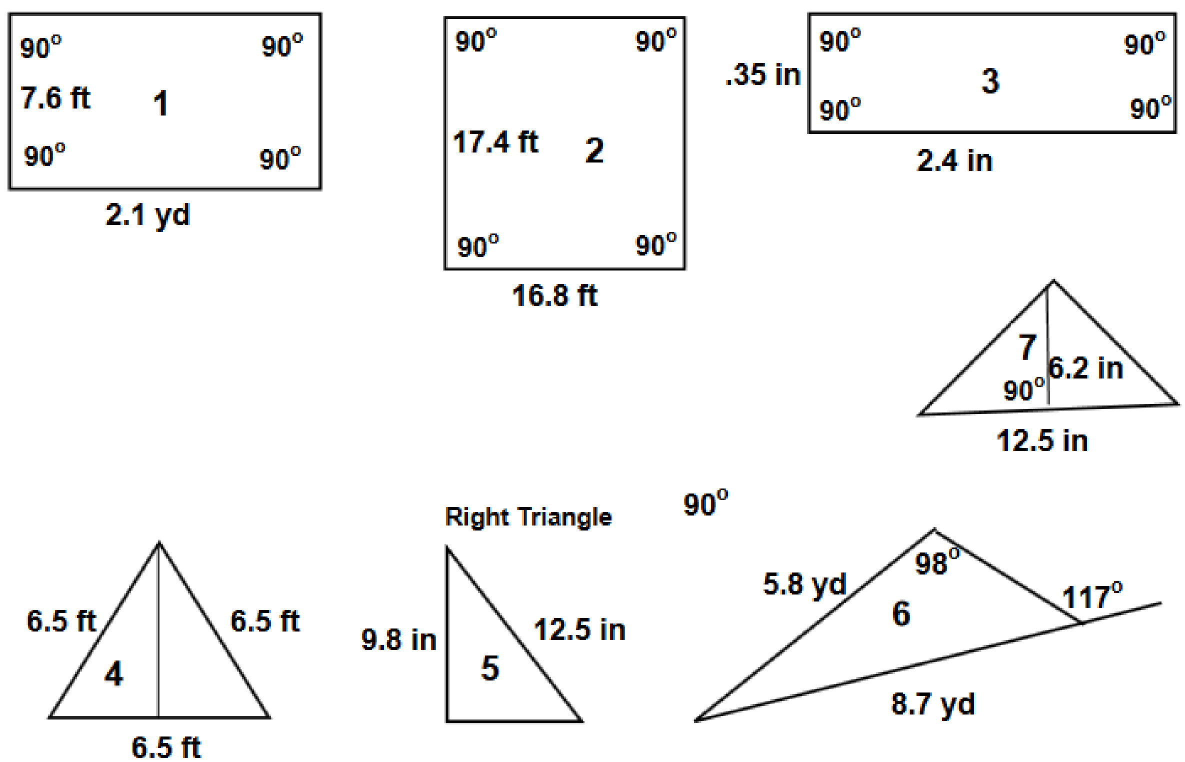
G8 Area of Triangles and Rectangles Problems

Calculate the areas of the triangles and rectangles.

Note: The lateral units of measurement must be the same.

DO NOT multiply **ft** times **yd** for example.

Answers: # Area.



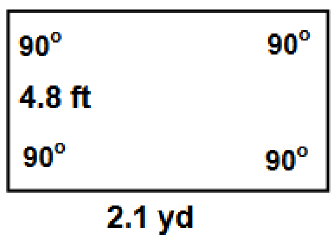
Answers: 1. 47.9 ft^2 or 5.3 yd^2 2. 292 ft^2 3. .84 in^2
4. 18.3 ft^2 5. 76 in^2 6. 8.2 yd^2 7. 38.8 in^2

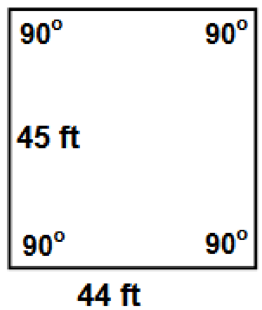
G8E

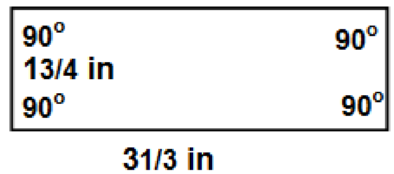
AREA OF TRIANGLES AND RECTANGLES

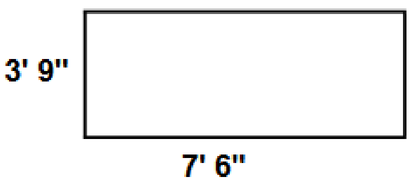
Calculate the areas of the triangles and rectangles.

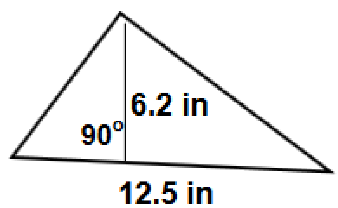
Note: The lateral units of measurement must be the same.

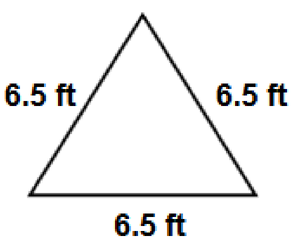


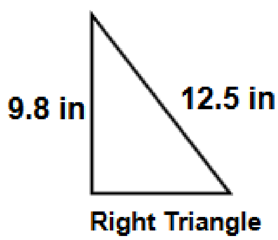


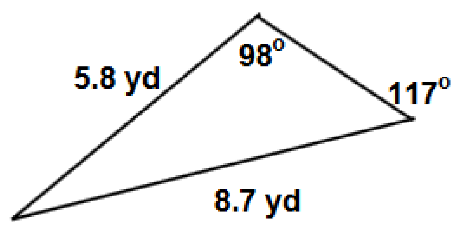












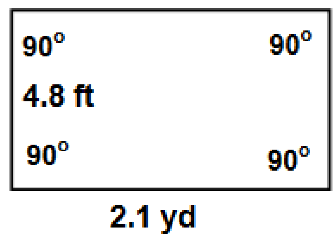
G8EA

AREA OF TRIANGLES AND RECTANGLES

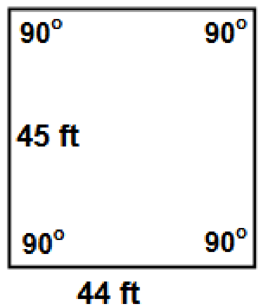
Calculate the areas of the triangles and rectangles.

Note: The lateral units of measurement must be the same.

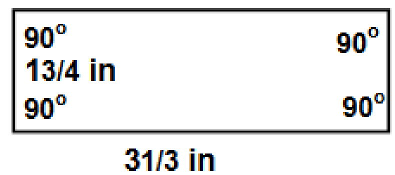
A = 30.2 ft^2 = 3.4 yd^2



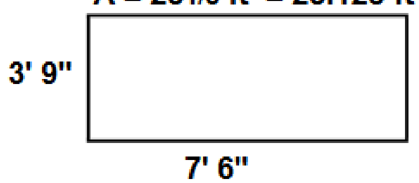
A = 1980 ft^2



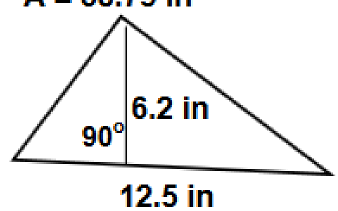
A = 5 5/6 in^2



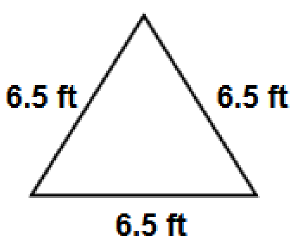
A = 28 1/8 ft^2 = 28.125 ft^2



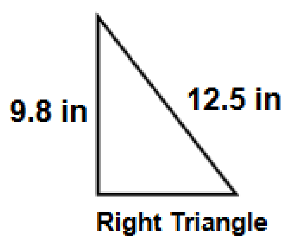
A = 38.75 in^2



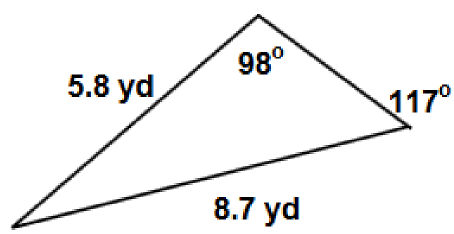
A = 18.3 ft^2



A = 38.0 in^2



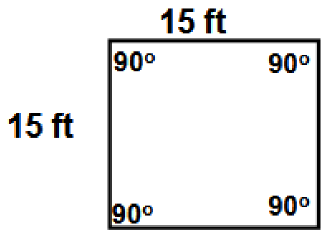
A = 8.2 yd^2

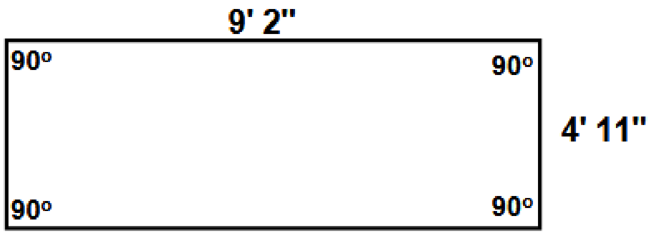


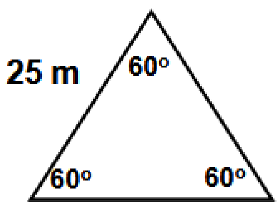
G8ES

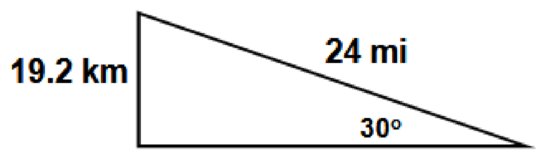
AREA OF TRIANGLES AND RECTANGLES

Identify the figures and calculate their areas. Be sure to check units and convert all numbers to the same unit where necessary.





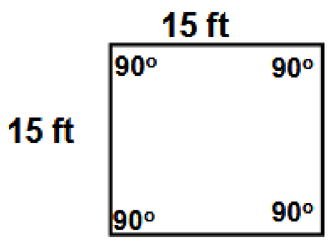




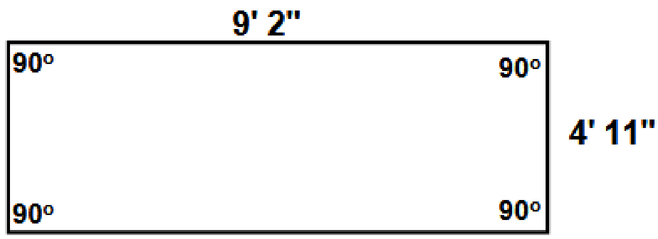
G8ESA

AREA OF TRIANGLES AND RECTANGLES

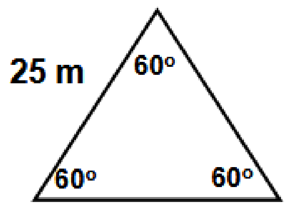
Identify the figures and calculate their areas. Be sure to check units and convert all numbers to the same unit where necessary.



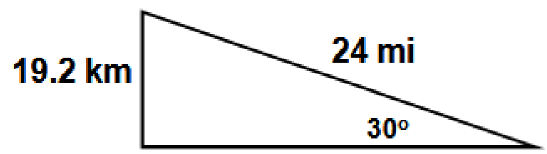
Square, A = 225 ft²



Rectangle, A = 45.07 ft²



Triangle, A = 270.6 m²



Right triangle, A = 124.7 mi² = 199.5 km²

G10 LESSON: CIRCLES π CIRCUMFERENCE

A **Circle** is a set of points equidistant from a point called the Center. This distance is called the **Radius** of the circle.

The distance across the **Circle** from one side to the other through the center is called the **Diameter** = 2x**Radius**

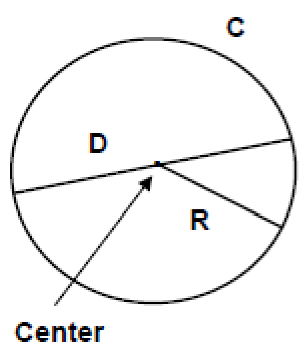
The **Circumference**, (**C**) of the **Circle** is the distance around the **Circle**, sort of its **perimeter**.

The ratio of the **Circumference** to the **Diameter** is always the same number for any circle. It is called **Pi** or π

Thus   **$C = \pi D = 2\pi R$**

$\pi = 3.141592654\ldots$ 22/7 is an approximation.

I usually use 3.14 unless I need a lot of accuracy, then I use 3.1416. π is called a "**transcendental number**."



R = Radius = Distance from center to any point on the circle.

D = Diameter = Distance across circle

C = Circumference

$C = \pi D = 2\pi R$

G10 Circles π Circumference Problems

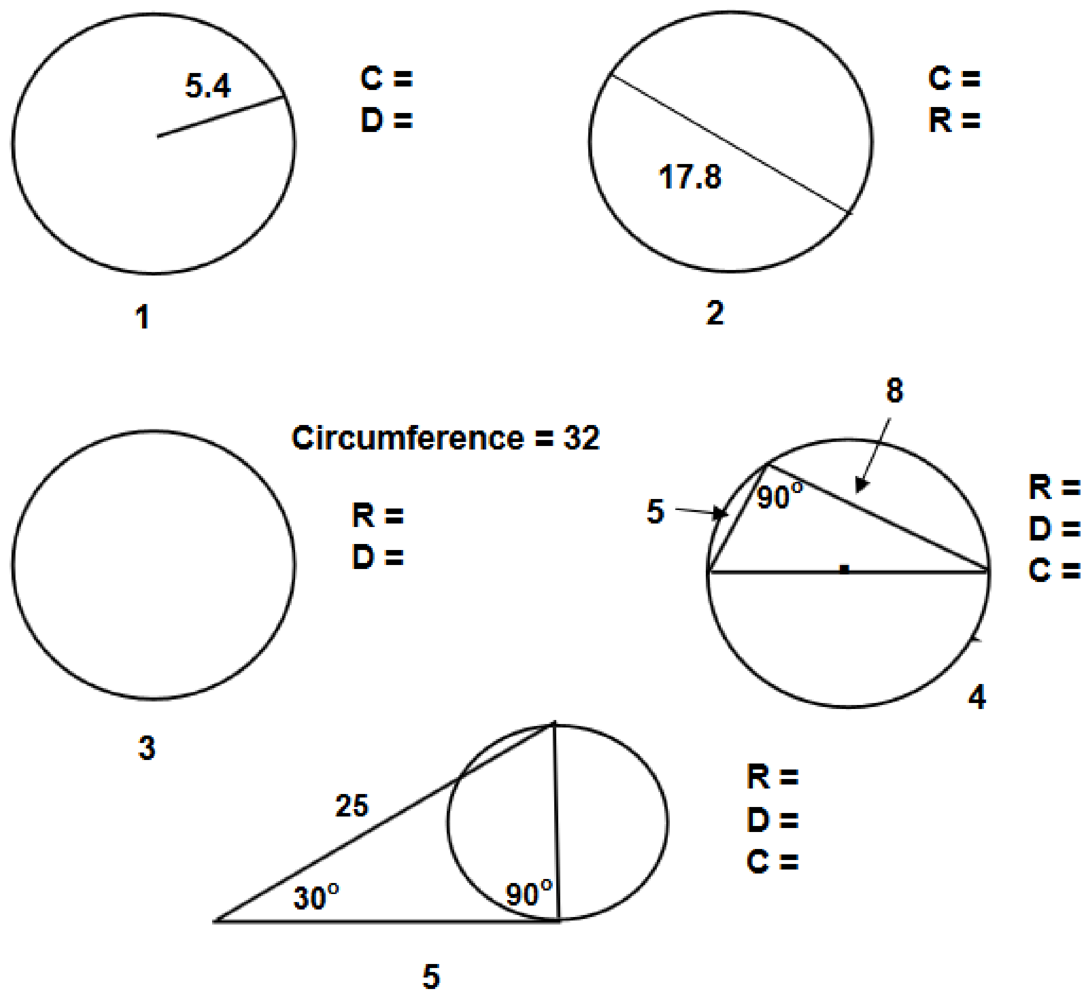
The TI-30Xa has a "π **Key**" we will use for π.

The three formulas we must remember are:

$$D = 2R \quad \textbf{and} \quad C = 2\pi R \quad \textbf{and} \quad A = \pi R^2 \text{ (next lesson)}$$

Find the unknown in the following problems.

Answers: **#, R, D, C**



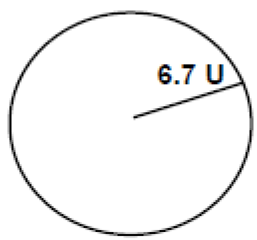
Answers **1. 5.4, 10.8, 33.9** **2. 8.9, 17.8, 55.9** **3. 5.1, 10.2, 32** **4. 4.7, 9.4, 29.6**
5. 6.25, 12.5, 39.3

G10E

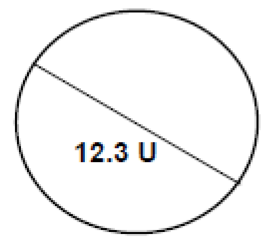
CIRCLES π CIRCUMFERENCE

R = Radius D = Diameter C = Circumference

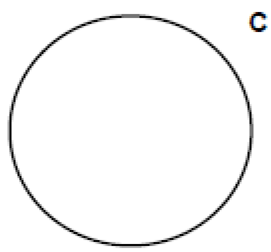
Find Unknowns



C = ? U
D = ? U

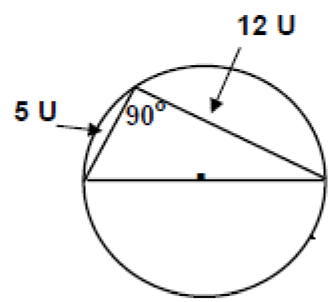


C = ? U
R = ? U

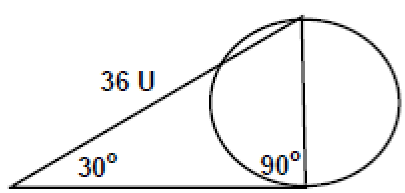


C = 53 U

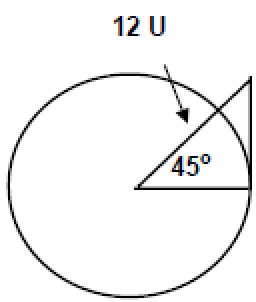
R = ? U
D = ? U



R = ? U
D = ? U
C = ? U

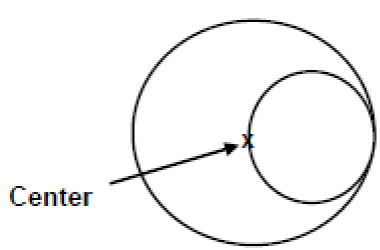


R = ? U
D = ? U
C = ? U



R = ? U
D = ? U
C = ? U

Inner Circle C = 15



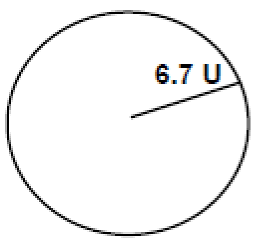
R = ? U
D = ? U
C = ? U

G10EA

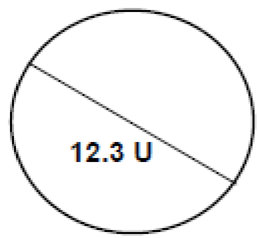
CIRCLES π CIRCUMFERENCE

R = Radius   D = Diameter   C = Circumference

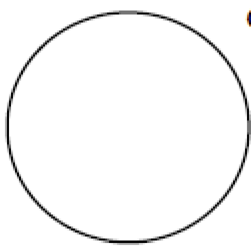
Find Unknowns



C = 42.1 U
D = 13.4 U

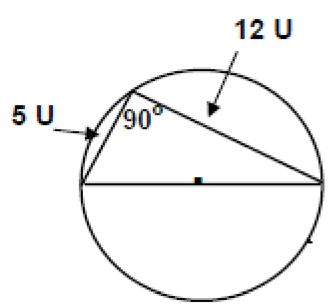


C = 38.6 U
R = 6.15 U

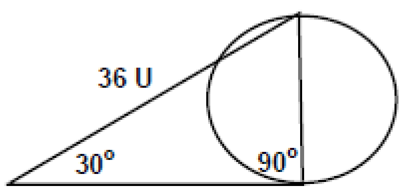


C = 53 U

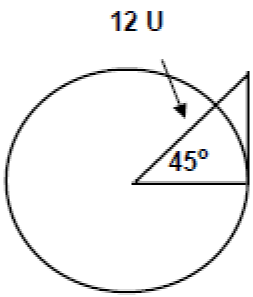
R = 8.4 U
D = 16.9 U



R = 6.5 U
D = 13 U
C = 40.8 U

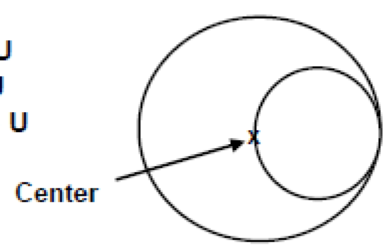


R = 9 U
D = 18 U
C = 56.6 U



R = 8.5 U
D = 17 U
C = 53.3 U

Inner Circle C = 15

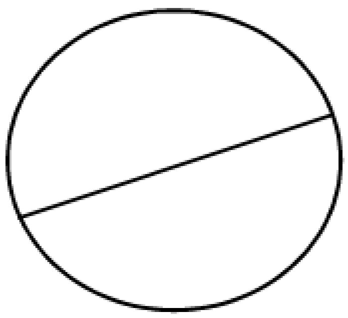


R = 4.8 U
D = 9.6 U
C = 30 U

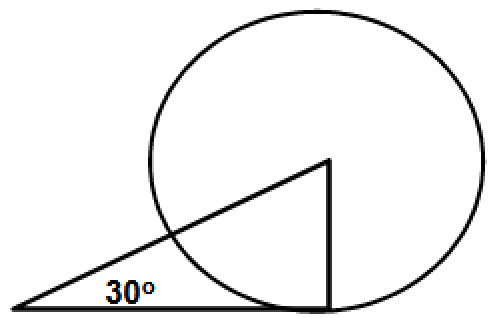
G10ES

CIRCLES π CIRCUMFERENCE

Identify the figures and calculate their perimeters. Be sure to check units and convert all numbers to the same unit where necessary.



d = 460,689 light years

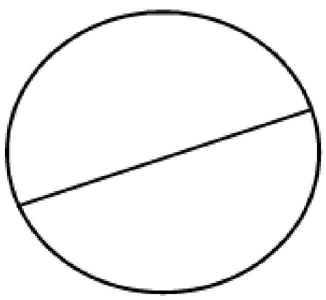


700 ft

G10ESA

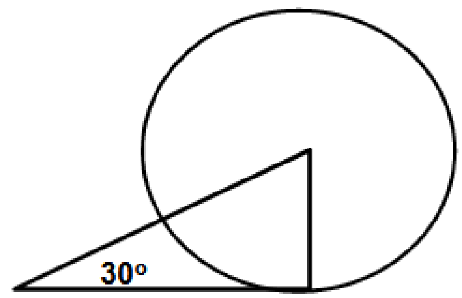
CIRCLES π CIRCUMFERENCE

Identify the figures and calculate their perimeters. Be sure to check units and convert all numbers to the same unit where necessary.



d = 460,689 light years

Circle, C = 460,689π ly = 1,447,297.2 ly



700 ft

Circle, C = 2539.32 ft

G11 LESSON: CIRCLES AREA A = π R2

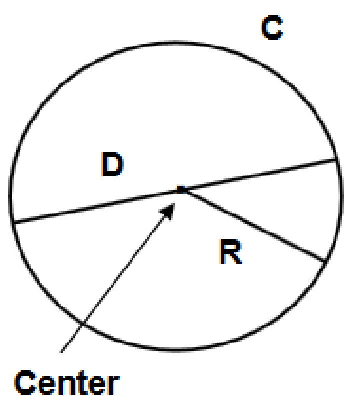
A **Circle** is a set of points equidistant from a point called the **Center**. This distance is called the **Radius** of the **circle.**

π is defined to be **C/D = Circumference/Diameter**

The **Area** (**A**) of the **Circle** turns out to be **A =** πR^2

This is a remarkable fact first discovered by the Greek genius mathematician **Archimedes.** It now is very easy to calculate the **Area** of any **Circle** using a calculator.

Remember: π is about 3.14



R = Radius = Distance from center to any point on the circle.

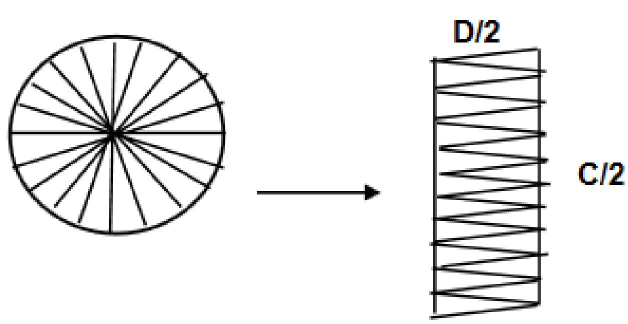
D = Diameter = Distance across circle

C = Circumference

C = $\pi D = 2\pi R$

A = πR^2

Archimedes "Proof" of Area. $A = (C/2)x(D/2) = (2\pi R/2)x(2R/2) = \pi R^2$



A = (D/2)X(C/2)

G11 Circles π Area Problems

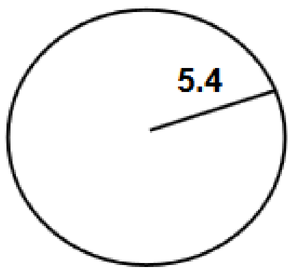
The TI-30Xa has a "π **Key**" we will use for π.

The three formulas we must remember are:

D = 2R **and** **C** = 2πR **and** **A** = πR2 (**next lesson**)

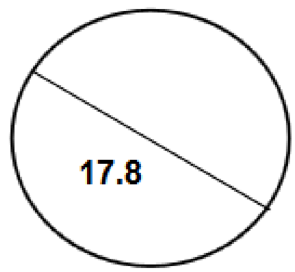
Find the Area in the following problems.

Answers: #, R, A



R =
A =

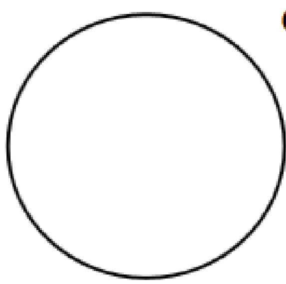
1



R =
A =

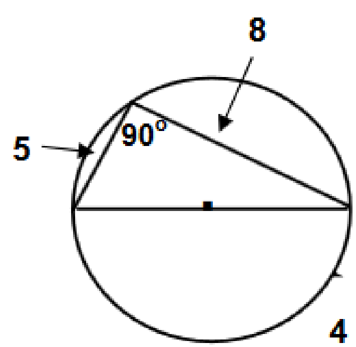
2

Circumference = 32



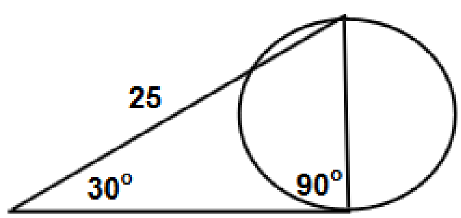
R =
A =

3



R =
A =

4



R =
A =

5

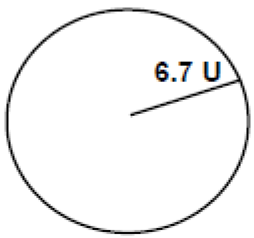
Answers **1. 5.4, 91.6** **2. 8.9, 249** **3. 5.1, 81.5** **4. 4.7, 70**
5. 6.25, 123

G11E

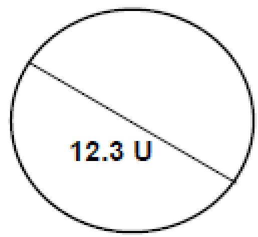
CIRCLES π AREA

R = Radius, **D** = Diameter, **C** = Circumference

Find Area

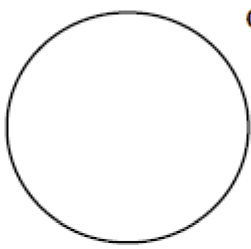


A = ? U^2

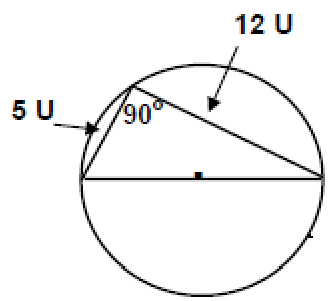


A = ? U^2

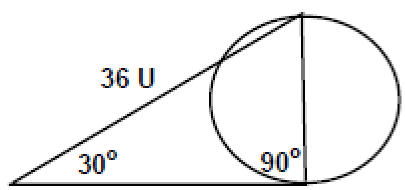
C = 53 U



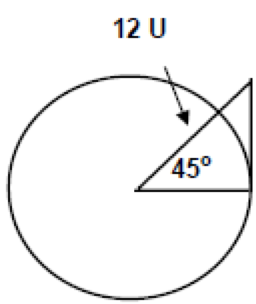
A = ? U^2



A = ? U^2

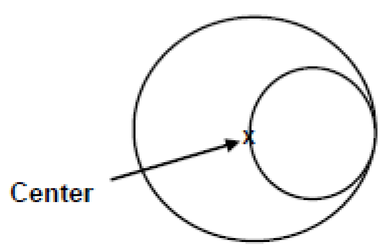


A = ? U^2



A = ? U^2

Inner Circle C = 15



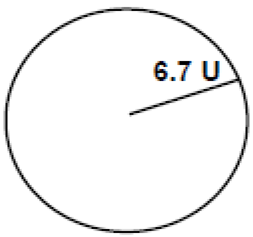
A = ? U^2

G11EA

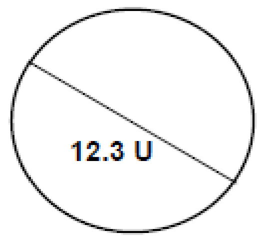
CIRCLES π AREA

R = Radius, D = Diameter, C = Circumference

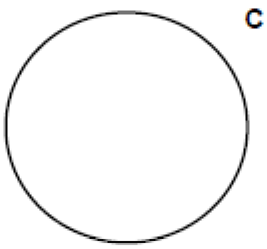
Find Area



A = 141 U^2

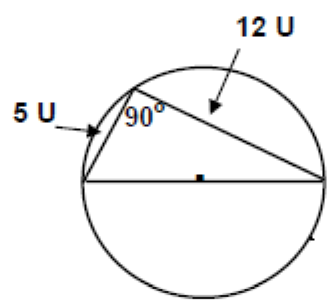


A = 118.9 U^2

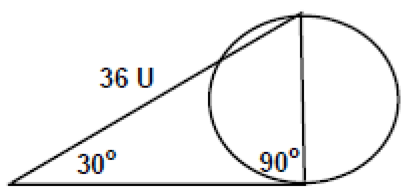


C = 53 U

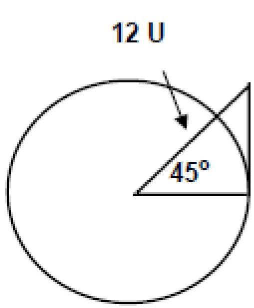
A = 223.5 U^2



A = 132.7 U^2

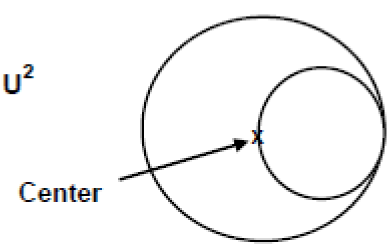


A = 254.5 U^2



A = 226 U^2

Inner Circle C = 15



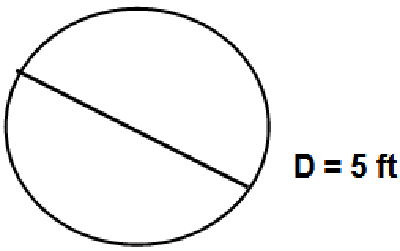
A = 71.6 U^2

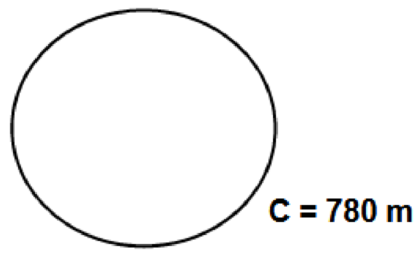
G11ES

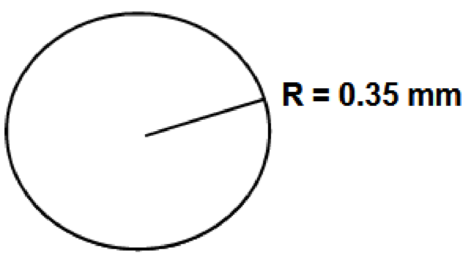
CIRCLES π AREA

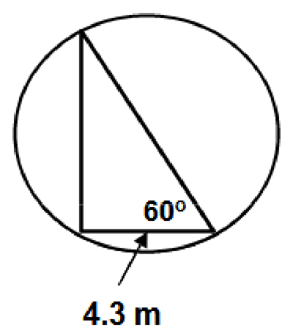
Calculate the areas of the figures below. Be sure to treat units appropriately!

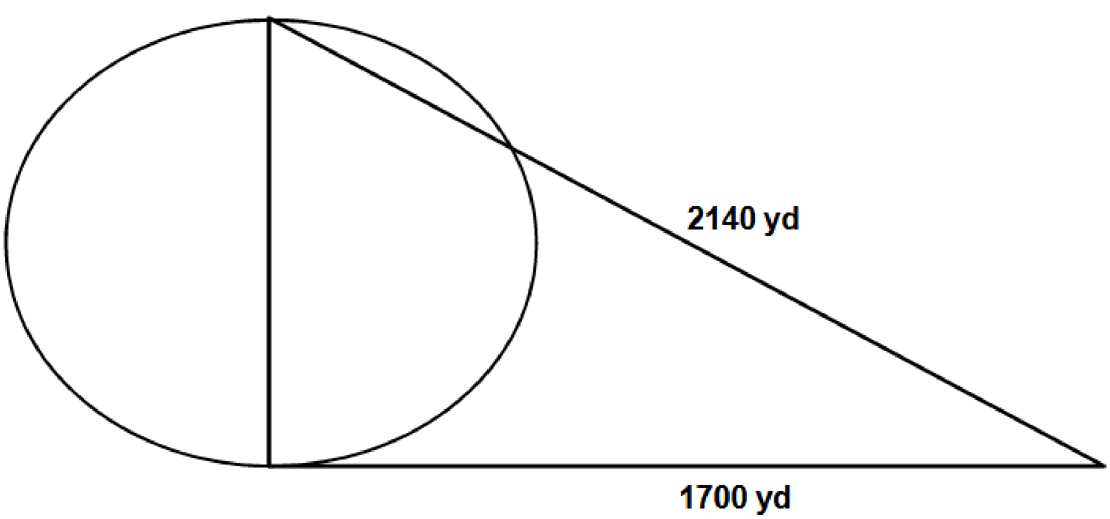
R = Radius, **D** = Diameter, **C** = Circumference









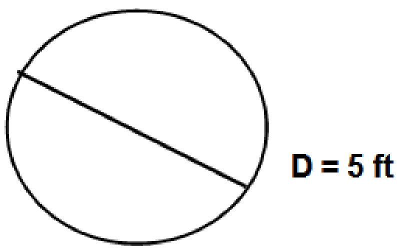


G11ESA

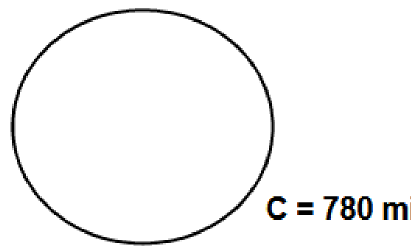
CIRCLES π AREA

Calculate the areas of the figures below. Be sure to treat units appropriately!

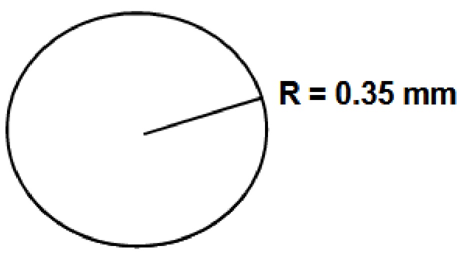
R = Radius, **D** = Diameter, **C** = Circumference



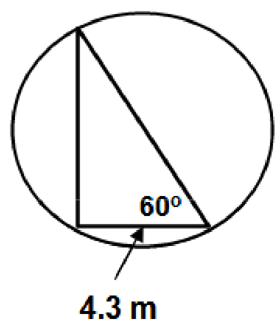
A = 19.6 ft^2



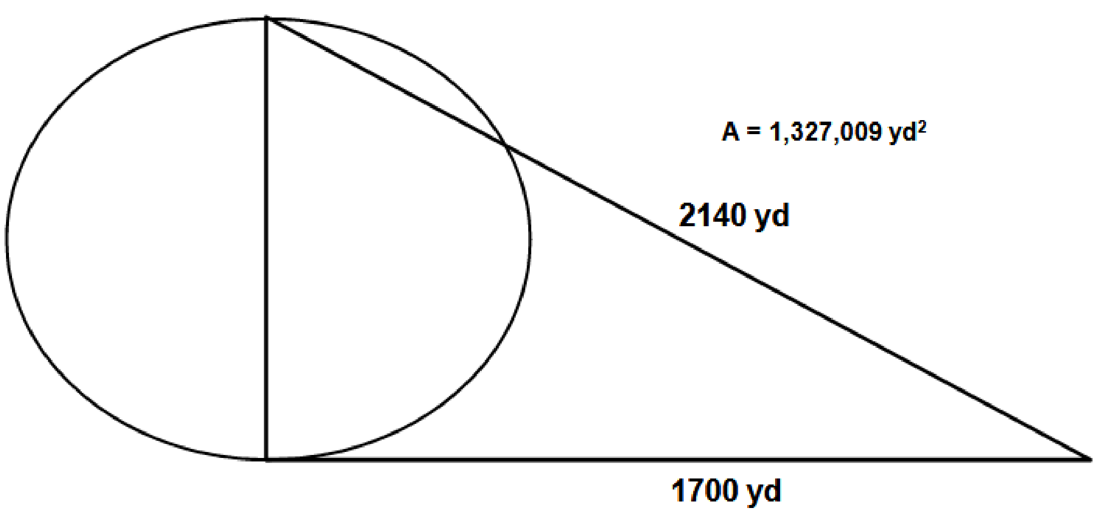
A = 48,415 mi^2



A = 0.385 mm^2



A = 43.57 m^2



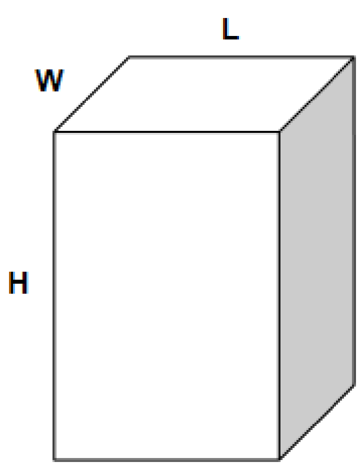
A = 1,327,009 yd^2

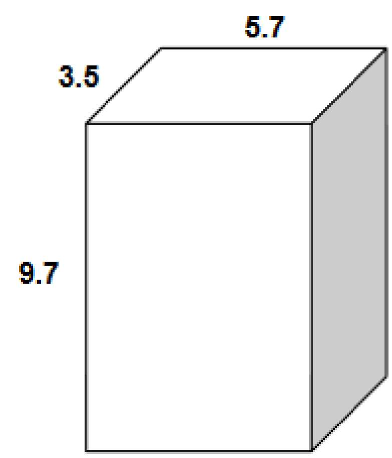
G13 LESSON: SURFACE AREAS BLOCKS AND CYLINDERS

Calculate the Area of each "**face**" or "**side**" for a block.

The **Ends** and then the **Lateral Area** for the **Cylinder**

Area is measured in **Square Units, U^2**

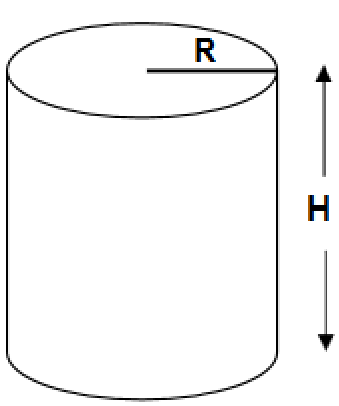


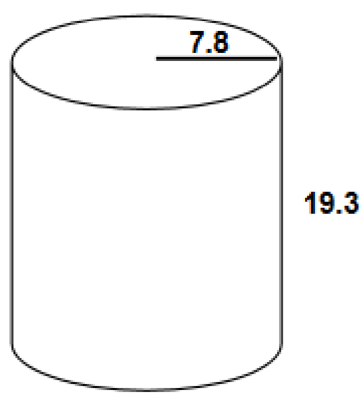


$A = 2HL + 2HW + 2LW$

$= 2(HL + HW + LW)$

$A = 2(3.5x5.7 + 3.5x9.7 + 5.7x9.7) = 218\ U^2$





$A = 2\pi R^2 + 2\pi RH$

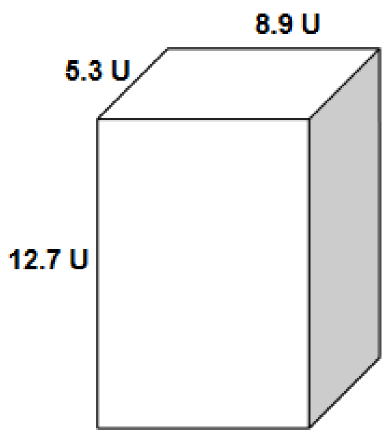
$= 2\pi R(R + H)$

$A = 2x\pi x7.8^2 + 2\pi x7.8x19.3 = 1328\ U^2$

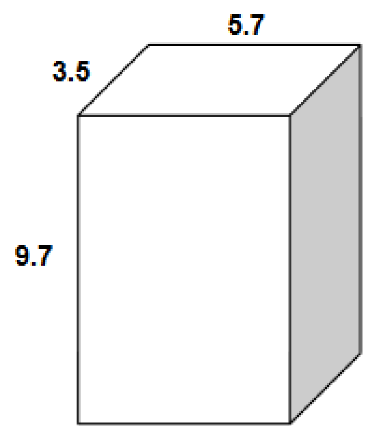
G13E

SURFACE AREAS BLOCKS AND CYLINDERS

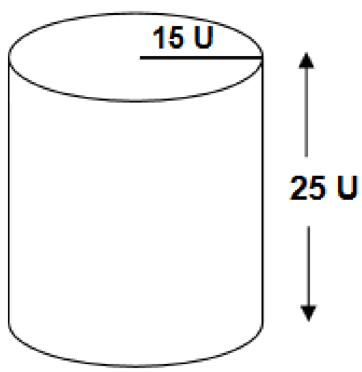
Calculate the Total Surface Area, U^2, in each case.



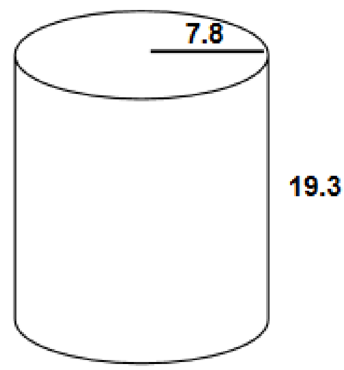
Area = ? U^2



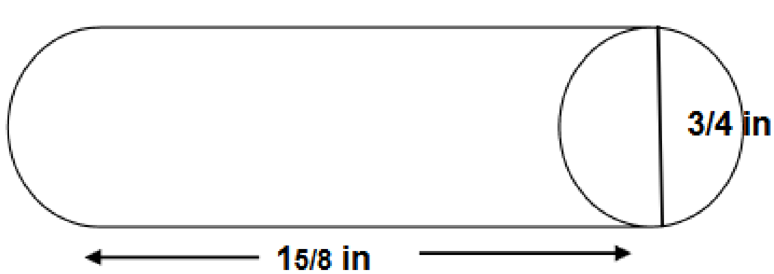
A = ? U^2



Area = ? U^2



A = ? U^2

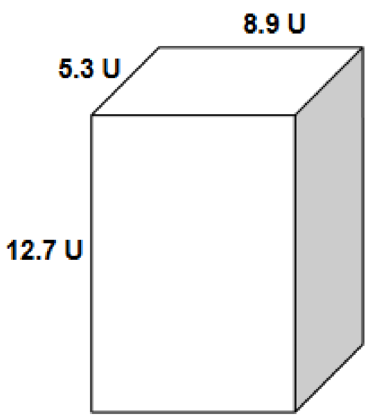


Total Surface Area = ? in^2

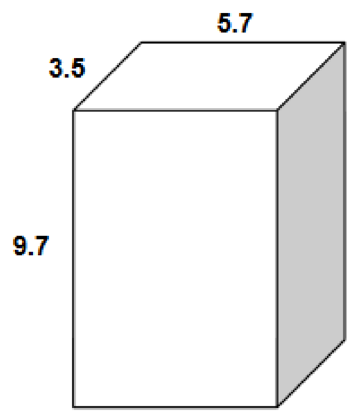
G13EA

SURFACE AREAS BLOCKS AND CYLINDERS

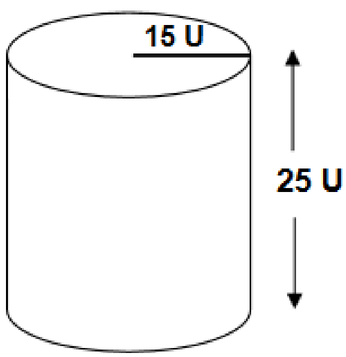
Calculate the Total Surface Area, $\mathbf{U^2}$, in each case.



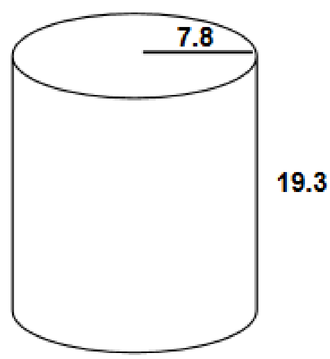
Area = 455 U^2



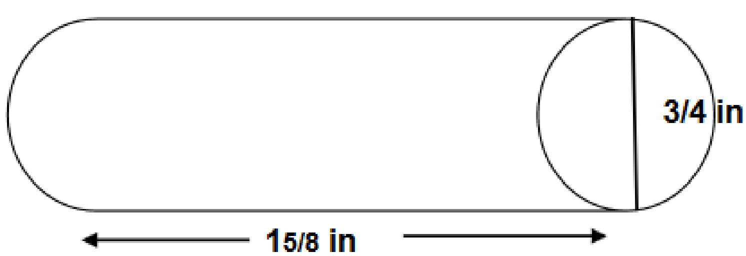
$A = 2(3.5 \times 5.7 + 3.5 \times 9.7 + 5.7 \times 9.7) = 218\ U^2$



Area = 3770 U^2



$A = 2\pi \times 7.8^2 + 2\pi \times 7.8 \times 19.3 = 1328\ U^2$

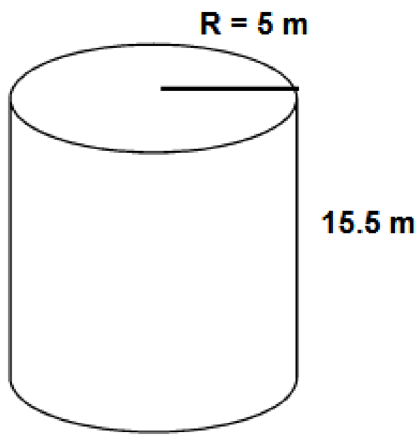


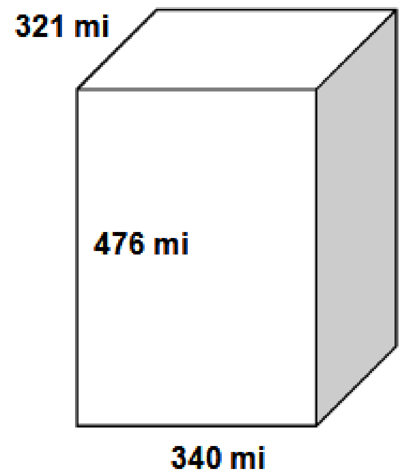
Total Surface Area = 4.71 in^2

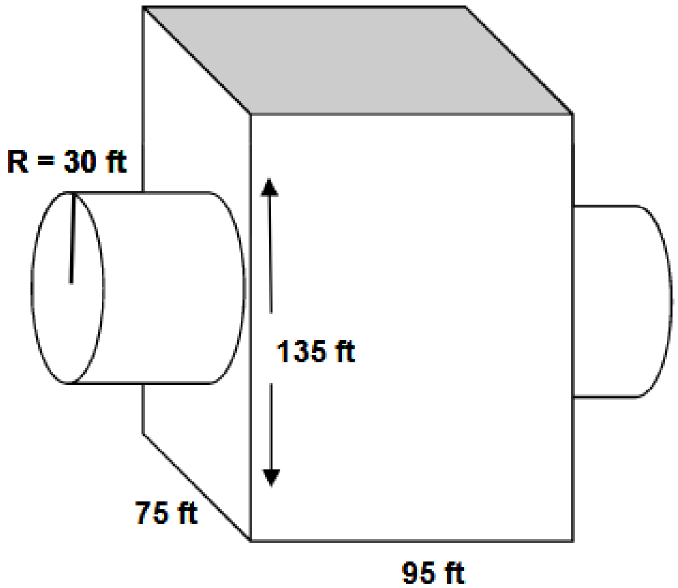
G13ES

SURFACE AREAS BLOCKS AND CYLINDERS

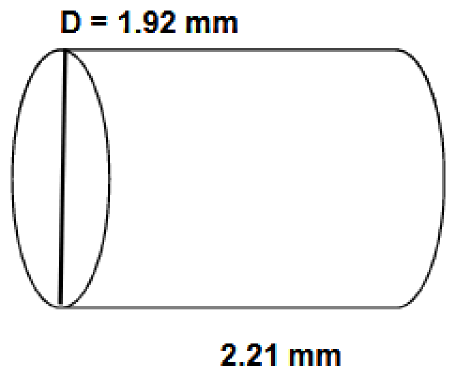
Calculate the surface area of the figures below. Be sure to treat units appropriately!







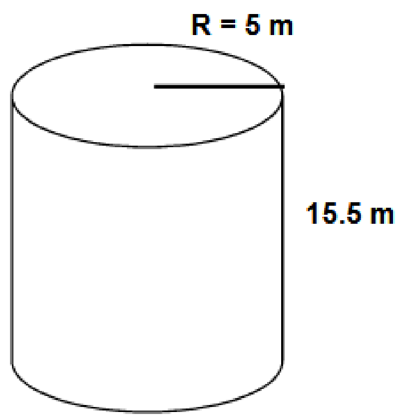
Note: the cylinder of length 140 ft is centered inside the block.



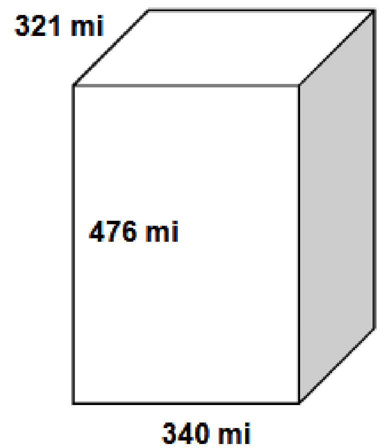
G13ESA

SURFACE AREAS BLOCKS AND CYLINDERS

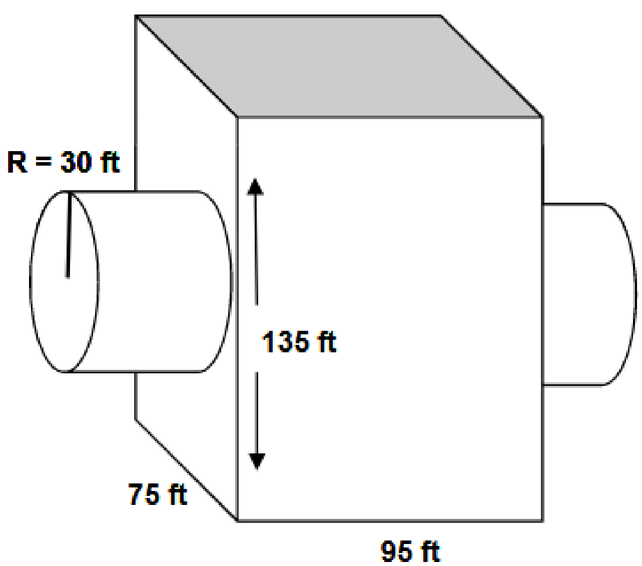
Calculate the surface area of the figures below. Be sure to treat units appropriately!



SA = 644 m^2

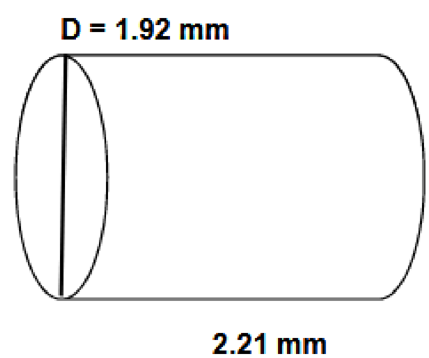


SA = 847,552 mi^2



Note: the cylinder of length 140 ft is centered inside the block.

SA = 68,632.3 ft^2

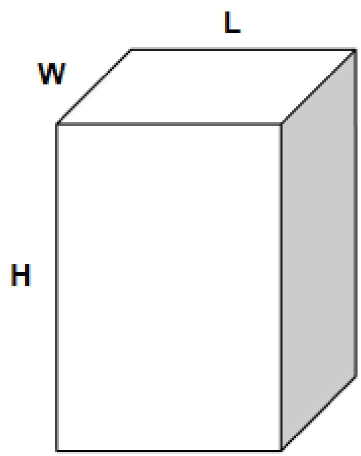


SA = 19.12 mm^2

G15 LESSON: VOLUMES BLOCKS AND CYLINDERS

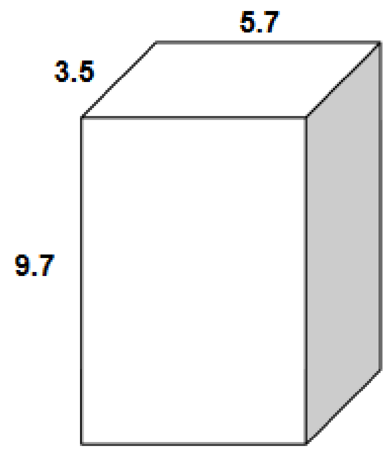
Volume = (**Area of Base**) x **Height**

Volume is measured in **Cubic Units, U^3**



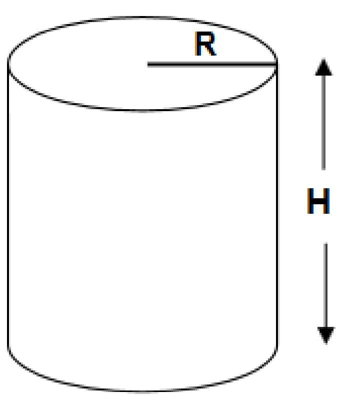
$A = 2HL + 2HW + 2LW$

$V = LWH$



$A = 2(3.5x5.7 + 3.5x9.7 + 5.7x9.7) = 218\ U^2$

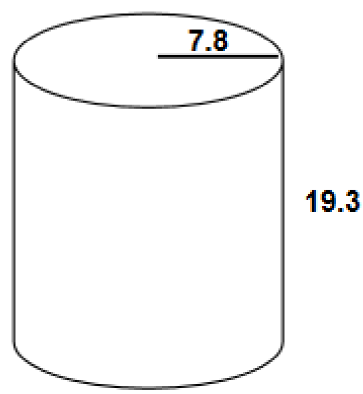
$V = 3.5x5.7x9.7 = 194\ U^3$



$A = 2\pi R^2 + 2\pi RH$

$= 2\pi R(R + H)$

$V = \pi R^2 H$



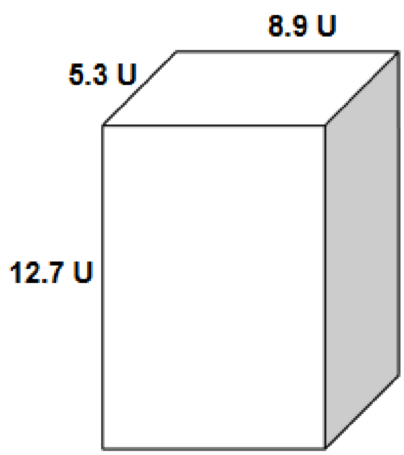
$A = 2x\pi x7.8^2 + 2\pi x7.8x19.3 = 1328\ U^2$

$V = \pi x7.8^2x19.3 = 1174\ U^3$

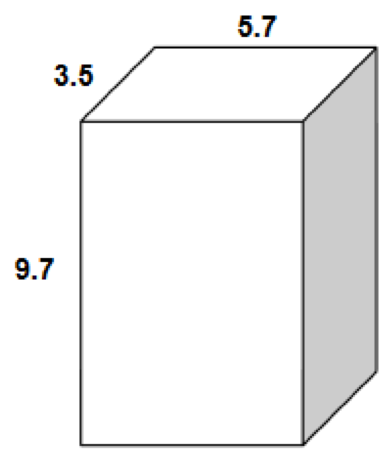
G15E

VOLUMES BLOCKS AND CYLINDERS

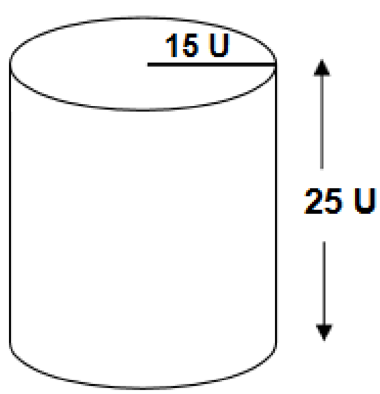
Calculate the **Volume, U^3**, in each case.



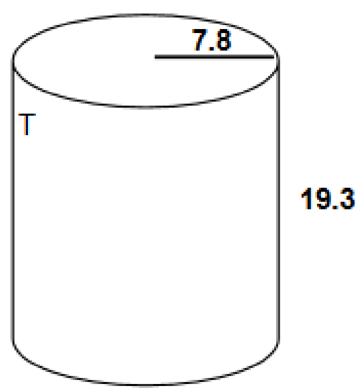
Volume = ? U^3



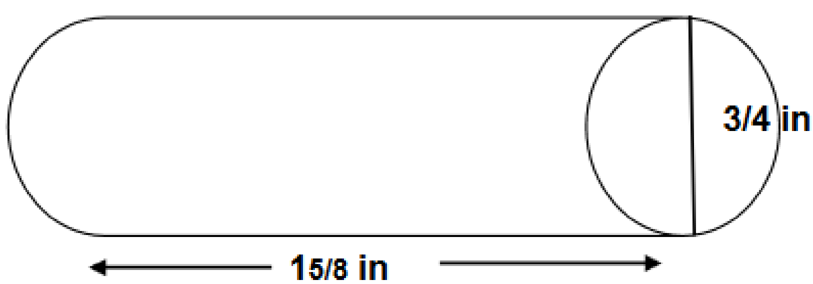
Volume = ? U^3



Volume = ? U^3



Volume = ? U^3

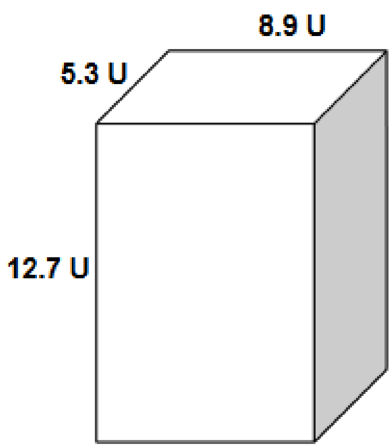


Volume = ? U^3

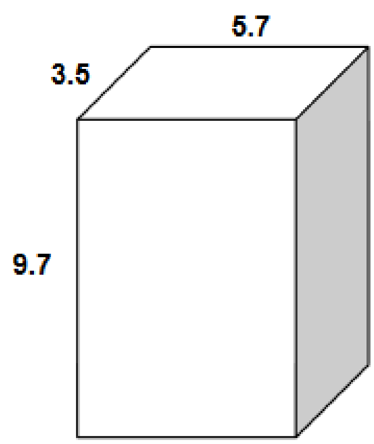
G15EA

VOLUMES BLOCKS AND CYLINDERS

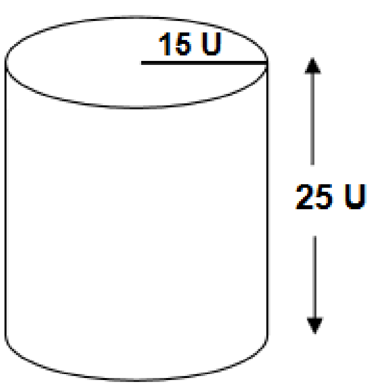
Calculate the **Volume, U^3**, in each case.



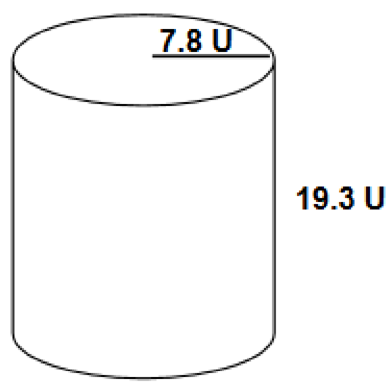
Volume = 599 U^3



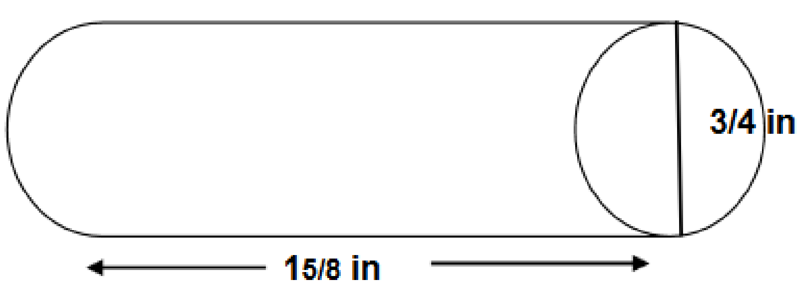
Volume = 193.5? U^3



Volume = 17,671 U^3



Volume = 3689 U^3

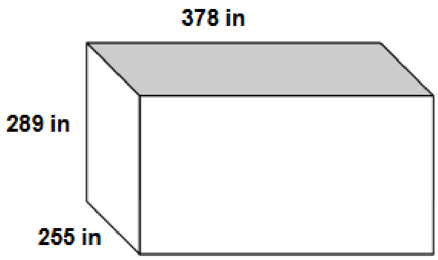


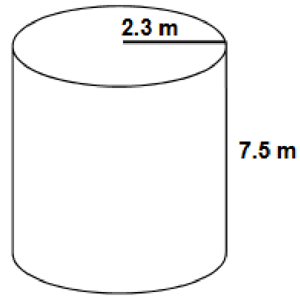
Volume = .718 in^3

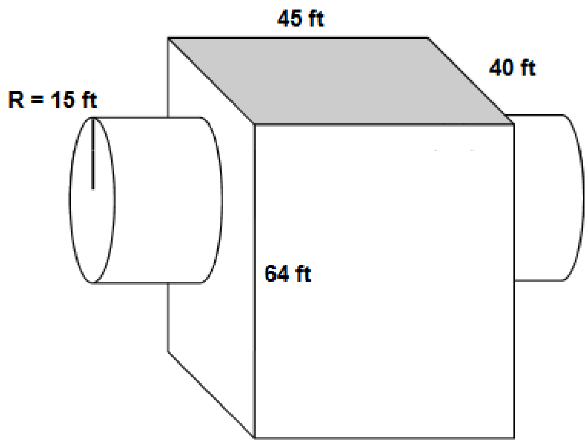
G15ES

VOLUMES BLOCKS AND CYLINDERS

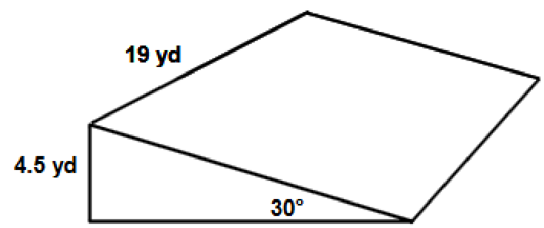
Find the volumes of the figures below. Be mindful of units!







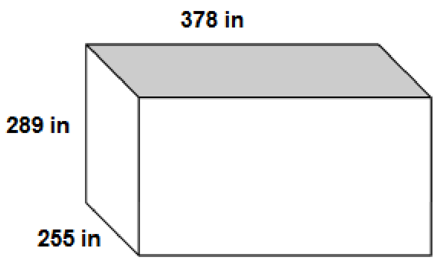
The cylinder of length 65 ft is centered inside the block.



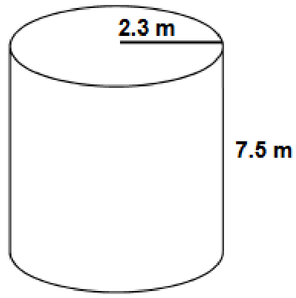
G15ESA

VOLUMES BLOCKS AND CYLINDERS

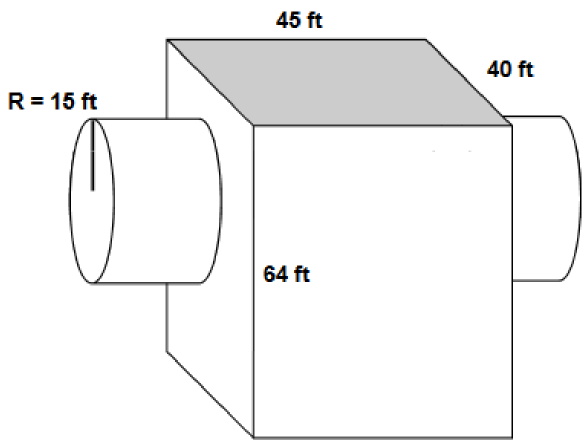
Find the volumes of the figures below. Be mindful of units!



V = 27,856,710 in^3

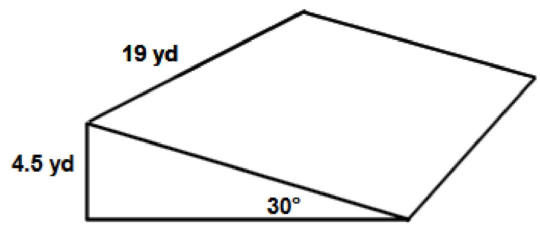


V = 124.6 m^3



The cylinder of length 65 ft is centered inside the block.

V = 129,337 ft^3



V = 333.2 yd^3

S1 LESSON: UNITS CONVERSION

Suppose you have two Units of Measurement

U_1 and U_2 and you wish to convert from one unit to the other, for example, cm and inches.

For example, you want to convert 23.4 cm to inches.

First, you must determine the conversion number.

You may look this up in some type of unit conversion table, or you can go to www.wolframalpha.com and get the answer or find the conversion number.

WA1 **Convert 1 cm to inches**

Answer: 1 cm = 0.3937 inches

Now, you have 23.4 cm = X inches and you want X.

Multiply both sides by 23.4 and get:

23.4 cm = 23.4x0.3937 inches = 9.2 inches

Of course, we could have gotten this directly from www.wolframalpha.com

WA2 **Convert 23.4 cm to inches**

Answer: 9.213

Suppose you wanted to convert 15.7 inches to cm?

1 cm = 0.3937 inches same as 1/0.3937 cm = 1 inch

Or, 1 inch = 2.54 cm since 1/0.3937 = 2.54

Then, 15.7 inches = 15.7x2.54 cm = 39.88 cm

Of course,

WA3 **convert 1 inch to cm**

Answer: 2.54

WA4 **convert 15.7 inches to cm**

Answer: 39.88

This type of process applies to any type of conversion of units. Of course, the units must be measuring the same thing like length or weight.

Example 1: convert 18.3 grams to ounces

First you must find a conversion factor for grams to ounces:

1 gm = .0353 oz you find somewhere.

Then, 18.3 gm = .0353x18.3 oz = .646 oz

WA5 **1 gram to ounce**

Answer: .03527

WA6 **18.3 gram to ounce**

Answer: .6455

The same process applies to any type of unit conversion.

For example, square feet to square meters:

1 sq meter = 10.76 square feet

Thus, 1 square foot = 1/10.76 sq m = .093m^2

Example 2: 4.7 sq m are how many sq ft?

Answer: 4.7x10.76 ft^2 = 50.57 ft^2

WA7 **4.7 sq m to sq ft**

Answer: 50.6

To get more accuracy:

WA8 **4.70 sq m to sq ft**

Answer: 50.59

WA9 **1 square meter to square feet**

Answer: 10.76

Example 3: 12.3 Kilograms is how many pounds?

WA10 **12.3 kilograms to pounds**

Answer: 27.12 lb = 27 lb 1.9 oz

Example 4: 3.4 cubic meters is how many cubic yards

1 m = 1.094 yd

1 m^3 = 1.0943^3 yd^3 = 1.309 yd

So 3.4 cu m = 3.4x1.309 cu yd = 4.45 cu yd

WA11 **3.4 cubic meter to cubic yard**

Answer: 3.45 cu yd

In general, if you have two units which measure the same quantity, U_1 and U_2, and you wish to convert from one unit to the other, then:

If you have access to www.WolframAlpha.com, you simply enter the command:

convert N U_1 to U_2

where N is the amount of the quantity you have expressed in U_1 and you will get the amount expressed in U_2.

If you don't have access to Wolfram Alpha, then you must find the conversion factor, C, where:

$1\ U_1 = CU_2$

Multiply both sides by N to obtain the answer:

$N\ U_1 = C \times N\ U_2$

Example: you know 1 mile = 1.609 kilometers

60 miles = 1.609x60 km = 96.54 km

So, you can see for example that:

100 km/hr is about 60 m/hr.

S1E

Units Conversion

1. Given the conversion factor 1 ft = 12 in, how many inches are in 1.5 ft?
2. Given the conversion factor 1 ft = 12 in, how many feet are in 14 in?
3. Given the conversion factor 1 m = 39.37 in, how many inches are in 2.8 m?
4. Given the conversion factor 1 m = 39.37 in, how many meters are in 76 in?
5. Given the conversion factor 1 in^2 = 6.452 cm^2, how many cm^2 are on an 8 ½ in x 11 in sheet of paper?
6. Given the conversion factor 1 in^2 = 6.452 cm^2, how many in^2 are in 100 cm^2?
7. Given the conversion factor 1 gal = 3.785 L, how many liters are in 19 gal?
8. Given the conversion factor 1 km^2 = 0.3861 mi^2, how many mi2 are in 15 km2?
9. Given the conversion factor 1 gal = 3.785 L, how many gallons are in 2 L?
10. If I want to pour a concrete house slab that is 52 feet long by 28 feet wide by 4 inches deep, how would I determine how many cubic yards of concrete would be needed?

UNITS CONVERSION

1. Given the conversion factor 1 ft = 12 in, how many inches are in 1.5 ft?

   1 ft = 12 in (You will also see this written as 12 in/ft.)

   1.5 ft = X in

   (12 in/ft)*(1.5 ft) = 18 in

   or

   WA **convert 1.5 ft to in**

   18 in

2. Given the conversion factor 1 ft = 12 in, how many feet are in 14 in?

   1 ft = 12 in

   1/12 ft = 12/12 in

   0.0833 ft = 1 in (You will also see this written as 0.0833 ft/in.)

   14 in = X feet

   (0.0833 ft/in)*(14 in) = 1.167 ft

   or

   WA **convert 14 in to ft**

   1.167 ft

3. Given the conversion factor 1 m = 39.37 in, how many inches are in 2.8 m?

   2.8 m = X in

   (39.37 in/m)*(2.8 m) = 110.24 in

4. Given the conversion factor 1 m = 39.37 in, how many meters are in 76 in?

   1 m = 39.37 in

   1/39.37 m = 39.37/39.37 in

   0.0254 m = 1 in (You will also see this written as 0.0254 m/in.)

   76 in = X m

   (0.0254 m/in)*(76 in) = 1.930 m

   or

   WA **convert 76 in to m**

   1.93 m

5. Given the conversion factor 1 in^2 = 6.452 cm^2, how many cm^2 are on an 8 ½ in x 11 in sheet of paper?

   (8 ½ in)*(11 in) = 93.5 in^2

   (6.452 cm^2/in^2)*(93.5 in^2) = 603.262 cm^2

   or

   WA **convert 93.5 inches^2 to cm^2**

   603.2 cm^2

   or

   WA **convert (8.5 inches)*(11 in) to cm^2**

   603 cm^2

   Note: The answers are actually the same. The slight differences occur during rounding.

6. Given the conversion factor 1 in^2 = 6.452 cm^2, how many in^2 are in 100 cm^2?

   1 in^2 = 6.452 cm

   1/6.452 in^2 = 6.452/6.452 cm^2

   0.155 in^2 = 1 cm^2 (You will also see this written as 0.155 in^2/ cm^2.)

   100 cm^2 = X in^2

   (0.155 in^2/ cm2)*(100 cm^2) = 15.5 in^2

   or

   WA **convert 100 cm^2 to in^2**

   15.5 in^2

7. Given the conversion factor 1 gal = 3.785 L, how many liters are in 19 gal?

   19 gal = X L

   (3.785 L/gal)*(19 gal) = 71.915 L

   or

   WA **convert 19 gal to L**

   71.92 L

8. Given the conversion factor 1 km^2 = 0.3861 mi^2, how many mi^2 are in 15 km^2?

   15 km^2 = X mi^2

   (0.3861 mi^2/km^2)(15 km^2) = 5.7915 mi^2

   or

   WA **convert 15 km^2 to mi^2**

   5.792 mi^2

9. Given the conversion factor 1 gal = 3.785 L, how many gallons are in 2 l?

1 gal = 3.785 L

1/3.785 gal = 3.785/3.785 L

0.2642 gal = 1 L (You will also see this written as 0.2642 gal/L.)

2 L = X gal

(0.2642 gal/L)*(2 L) = 0.5284 L

or

WA **convert 2 L to gal**

0.5283 L

10. If I want to pour a concrete house slab that is 52 feet long by 28 feet wide by 4 inches deep, how would I determine how many cubic yards of concrete would be needed?

27 ft^3 = 1 yd^3

27/27 ft^3 = 1/27 yd^3

1 ft^3 = 0.0370 yd^3

1 ft = 12 in

1 in = 0.0833 ft. (See A1 for math conversion.)

First, convert in to ft.

4 in = X ft

(0.0833 ft/in)(4 in) = 0.3332 ft

Next, calculate number of ft^3.

(52 ft)(28 ft)(0.3332 ft) = 485.1392 ft^3

Finally, convert ft^3 to yd^3

485.1392 ft^3 = X yd^3

(0.0370 yd^3/ft^3)(485.1392 ft^3) = 17.968 yd^3

S2 LESSON: DMS Degrees – Minutes - Seconds

There are 360°, or Degrees, in one revolution or circle.

In the DD (decimal degrees) system we express degrees with decimal notation. 37.45 degrees means 37 and 45/100 degrees.

In the DMS system, 1 degree = 60 minutes, or 1° = 60′

And 1 minute = 60 seconds, or 1′ = 60″

So, 1′ = (1/60)° and 1″ = (1/60)′ = (1/3600)°

We can express degrees in either DD or DMS format and convert degrees from DD to DMS and DMS to DD using the TI30Xa calculator.

DMS → DD is 2^{nd} +

DD → DMS is 2^{nd} =

Example:

6.5° = 6°30′ 00″00

6.55° = 6°33′ 00″00

6.57° = 6°34′ 12″00

6.573° = 6°34′ 22″80 (this means 22.80″)

127.875° = 127°52′ 30″

57.382° = 57°22′ 55″2 (this means 55.2″)

To apply the DMS → DD conversion you must enter the angle in the following format:

6°34’ 22”80 is entered: 6.342280 2nd +

Answer: 6.573°

26°4’ 2”50 is entered: 26.040250 2nd +

Answer: 26.06736

Now enter 26.06736° and get 26°04’ 02”5

It is possible to do these conversions manually with formulas, but it is best to do it with a calculator.

S2E

DMS Degrees – Minutes - Seconds

Convert the following decimal degree (DD) numbers to degrees-minutes-seconds (DMS).

1. 87.625
2. 137.6489
3. 65.475698
4. 19.01325
5. 45.4557

Convert the following degrees-minutes-seconds (DMS) to decimal degree (DD) numbers.

6. 66°18’12”0
7. 78°45’06”4
8. 180°04’07”
9. 97°09’45”7
10. 54°57’27”4

S2EA

THE NUMBER LINE, NEGATIVE NUMBERS

Answers: [ ]'s

Convert the following decimal degree (DD) numbers to degrees-minutes-seconds (DMS).

1. 87.625

   [**87°37'30"00**]

2. 137.6489

   [**137°38'56"**]

3. 65.475698

   [**65°28'32"5**]

4. 19.01325

   [**19°00'47"7**]

5. 45.4557

   [**45°27'20"5**]

Convert the following degrees-minutes-seconds (DMS) to decimal degree (DD) numbers.

6. 66°18'12"0

   [**66.30333333**]

7. 78°45'06"4

   [**78.75177778**]

   Note: If you get an answer of 78.75167778, what you did is enter into your calculator "78.450604" instead of "78.45064" before you hit the DMS → DD key. Anything after the " symbol, in this case 06"4, should be treated as 6.4 seconds, therefore, entering a 0 before the 4 would be incorrect.

8. 180°04’07”

[**180.0686111**]

9. 97°09’45”7

[**97.162269444**]

Note: If you get an answer of 97.16251944, what you did is enter into your calculator “97.094507” instead of “97.09457” before you hit the DMS → DD key.

10. 54°57’27”4

[**54.95761111**]

Note: If you get an answer of 54.95751111, what you did is enter into your calculator “54.572704” instead of “54.57274” before you hit the DMS → DD key.

S3 LESSON: y^x EXPONENTS

y^x means y times itself x times

y is called the base,

x is called the exponent

Examples:

$2^3 = 8$; $3^2 = 9$; $5^4 = 625$; $10^5 = 100{,}000$

The y^x key is the east way to calculate this.

Clear the calculator

Enter 2 and press the y^x

Enter 3 and press the = key

Answer: 8

Do all of the above.

y can be any positive number

x can be any number

$\sqrt[x]{y}$ means the x^{th} root of y

same as $y^{(1/x)}$ $[\sqrt[x]{y}]^x = y = \sqrt[x]{(y^x)}$

$\sqrt[3]{8} = 2 = 8^{1/3}$

$1.7^{2.7} = 4.19$

$2^{10} = 1024$ Kilo $\sqrt[10]{1024} = 2 = 1024^{1/10}$

Metric		Digital
$10^3 = 1000$	Kilo	$2^{10} = 1024$
$10^6 = 1{,}000{,}000$	Mega	$2^{20} = 1{,}048{,}576$
$10^9 = 1{,}000{,}000{,}000$	Giga	$2^{30} = 1{,}073{,}741{,}824$
$10^{12} = 1{,}000{,}000{,}000{,}000$	Tera	$2^{40} = 1{,}099{,}511{,}627{,}776$

Compound interest at 5% for 40 years:

$1.05^{40} = 7.04$

$1.06^{40} = 10.3$

$1.25^{25} = 265$ Kmart growth rate 25%/yr

$1.56^{25} = 67{,}315$ Walmart growth rate 56%/yr

$(1 + 1/1{,}000{,}000)^{1{,}000{,}000} = 2.718 = e$

Negative exponents

$y^{-x} = 1/y^x$

$9^{-2} = 1/9^2 = 1/81 = .012345679$

$9^{-1/2} = 1/3 = 1/9^{1/2}$

$5.7^{-1.3} = .104$

$.58^{-3.2} = 5.715$

$-3^{.5} = \text{Error}$

Exponents are very common in many situations. The calculator makes it very easy to deal with them. Just follow the rules.

Of course, Wolfram Alpha also will deal with them very easily.

S3E

y^x EXPONENTS

Use your calculator to solve the following exercises.

1. 4^7 =

2. 10^9 =

3. $4.2^{3.6}$ =

4. 8 √256 =

5. 6 √1,000,000 =

6. ${}^{3.2}\sqrt{8.3}$ =

7. 7^{-2} =

8. $56^{-2.4}$ =

9. $0.47^{-3.1}$ =

10. If production increases at a rate of 6.5%/year, what is your production after 15 years?

11. If production increases at a rate of 7.5%/year, what is your production after 15 years?

12. For the following exponents, match them with their name:

1. 10^3 = 1,000	a. Giga (Digital)
2. 10^6 = 1,000,000	b. Tera (Digital)
3. 10^9 = 1,000,000,000	c. Giga (Metric)
4. 10^{12} = 1,000,000,000,000	d. Tera (Metric)
5. 2^{10} = 1,024	e. Mega (Metric)
6. 2^{20} = 1,048,576	f. Kilo (Metric)
7. 2^{30} = 1,073,741,824	g. Mega (Digital)
8. 2^{40} = 1,099,511,627,776	h. Kilo (Digital)

S3EA

y^x EXPONENTS Answers: [ ]'s

Use your calculator to solve the following exercises.

1. 4^7 = [**16,384**]

2. 10^9 = [**1,000,000,000**]

3. $4.2^{3.6}$ = [**175.266**]

4. 8 √256 = [**2**]

5. 6 √1,000,000 = [**10**]

6. $^{3.2}\sqrt{8.3}$ = [**1.937**]

7. 7^{-2} = [**0.020**]

8. $56^{-2.4}$ = [**0.0000637**]

9. $0.47^{-3.1}$ = [**10.387**]

10. If production increases at a rate of 6.5%/year, what is your production after 15 years?
    [**1.065^{15} = 2.572**]

11. If production increases at a rate of 7.5%/year, what is your production after 15 years?
    [**1.075^{15} = 2.959**]

12. For the following exponents, match them with their name:
    [**1f, 2e, 3c, 4d, 5h, 6g, 7a, 8b**]

S4 LESSON: Density = Weight/Volume

How much does 55 gallons of water weigh (in lbs)?

How much does 55 gallons of gasoline weigh?

How much does 55 gallons of cement weigh?

How much does 55 gallons of mulch weigh?

Weight is measured in units such as:
Grams (gm), pound (lb), ounce (oz),
kilograms (kg), stone (st), etc

Volume is measured in such units as:
gallons(gal), quarts (qt), fluid ounces (fl oz),
liters (ltr), cubic inches (cu in or in^3),
cubic feet (cu ft or ft^3), or in general cubic U (cu U or U^3) where
U is a linear length, etc.

Suppose 1 gallon of water weighs 8.345 lbs

Then, 55 gallons would weigh 55x8.345 = 459 lbs

How do you find out what 1 gallon of water weighs?

Well, you could weigh a quart of water and multiply by 4, since 4 quarts equals one gallon.

Or, you could weigh 1 oz of water and multiply by 128 since one gallon is 128 oz.

Or, you could weigh a container full of water whose volume is 12 oz and then multiply by 128/12

Of course, you must subtract the weight of the empty container!

The Density of water is what you are computing.

Density = Mass/Volume = Weight/Volume

D = W/V or W = DV or V = W/D

So, if you know any two of these, then you always can calculate the third.

The units must always match up.

If W is lb and V is ft^3, the D must be lb/ft^3

D could be lb/gal, or oz/quart, or gm/liter, etc.

Above we determined a W and V in an experiment and calculated D, and then used this D to calculate the W when we were given the V.

What you always want to do first is learn the D for a substance.

For example, D for gasoline is 6.06 lb/gal

So, 55 gallons of gasoline would weigh:

55x6.06 = 333 lbs   VxD = W   galx(lb/gal) = lb

BUT, how do we know D for gasoline?

1. We could look it up in some table of densities.
2. We could find out on the Internet. My favorite is www.wolframalpha.com
3. We could do the experiment by weighing a known volume, usually pretty small.

WA1 **density of gasoline in lb/gal**

Answer: 6.06 lb/gal

But, suppose you did the experiment and found that 24.7 cu in of gasoline weighed 10.4 oz?

10.4/24.7 = .42 oz/in^3

WA2 **convert .42 oz/in^3 to lb/gal**

convert this to lb/gal

Answer: 6.06 lb/gal as it should be.

Note: Do you think I actually did this experiment?

Of course not, I just used WA backwards

WA3 **convert 6.06 lb/gal to oz/in^3**

Answer: .42 oz/in

But, in many cases, you won't be able to find the Density of a substance in any handbook, or even on Wolfram Alpha. So then, you simply must do the experiment with a convenient container.

1. Compute its volume.
2. Fill it up with the substance.
3. Calculate the Density of this substance.

Then you can find either V or W if you know the other one.

For example, how many cubic yards will one ton of insulation material fill up?

Suppose we do the experiment and find that the density of some insulation material is 2.5 lbs/gal. (I have no idea what it really would be.)

Then, WA tells us the density would be:

WA4 **convert 2.5 lbs/gal to lbs/yd^3**

Answer: 505 lbs/cu yd

So, V = W/D yields 2000/505 = 4 yd^3 as the answer.

How much does 55 gallons of cement weigh?

WA5 **density of cement in lb/gal**

Answer: 16.8 lb/gal

So 55 gallons weighs 55x16.8 = 924 lbs

If in doubt, actually do the experiment and weigh a small amount and then do the calculations.

How much does 55 gallons of mulch weigh?

WA6 **density of mulch in lb/gal**

WA doesn't know. You will probably just have to do the experiment and calculate the density.

So now, you can do a bunch of problems.

Sometimes, WA will give you the density.

Sometimes you will have to find it by experiment.

Use some handy container whose volume you know or can compute. And, fill it up and weight it. Subtract the empty container weight. Then, use WA to convert it to the Units you want.

S4E

Density = Weight/Volume

Use your calculator to solve the following exercises.

1. 1 quart of seawater (salt water) weighs 2.138 lb. What is the density of seawater (lb/gal)?

2. The density of propane is 0.0156843 lb/gal. A residential tank holds 250 gal. of propane. What is the weight (lb) of the propane in that tank?

3. The density of gold is 11.2 oz/ in^3. What is the volume (in^3) of 16 oz. (or 1 lb) of gold?

4. A quart of whole milk weighs 2.3 lb. What is the density (gal) of whole milk in lb/gal?

5. An adult is recommended to limit their salt intake to no more than 2300 mg per day. If the density of salt is 10,600 mg/tsp (teaspoons), what is the volume of salt (tsp) an adult should not exceed per day?

6. A grass catcher for a mower holds 4.4 ft^3 of grass. If the density of grass is 17.4 lb/ ft^3, what is the weight (lb) of the grass in the catcher?

7. You buy a pool which is 24 ft in diameter and fills with water to 4 ft deep. The density of water is 8.345 lb/gal. How much does the water in your pool weigh (lb)? Useful information: 1 ft^3 = 7.481 gal.

8. A ream (500 sheets) of 8.5 in x 11 in standard office paper is 2 in thick, and weighs 5 lb. What is the density of the paper (oz/in^3)? Useful information: 1 lb = 16 oz.

9. If 1 lb of feathers has a density of 0.0025 g/cm^3, what is the volume of those feathers (cm^3 and ft^3)? Useful information: 1 lb = 453.6 g; 1ft^3 = 28,317 cm^3

10. A bag of concrete mix weighs 80 lb. and has a dry volume of 0.53 ft^3. If 4 liters (L) of water are added to the mix, what is the final weight (lbs.) of the concrete? Also, what is the final volume (ft^3) that the bag will fill once mixed with water? Use these numbers to calculate the density (lb/ft^3). Useful information: Density of water: 1000 g/L (grams/liter); 1 lb = 453.6 g; 1 L = 0.03531 ft^3

S4EA

Density = Weight/Volume Answers: [ ]'s

1. D = W/V

   D = 2.138 lb/1 quart

   D = (2.138 lb/quart)x(4 gal/quart)

   D = 8.552 lb/gal

2. W = VD

   W = (250 gal)x(0.0156843 lb/gal)

   W = 3.92 lb

3. V = W/D

   V = (16 oz)/(11.2 oz/in^3)

   V = 1.43 in^3

4. D = W/V

   D = 2.3 lb/1 quart

   D = (2.3 lb/quart)x(4 gal/quart)

   D = 9.2 lb/gal

5. V = W/D

   V = (2300 mg)/(10,600 mg/tsp)

   V = 0.217 tsp

6. W = VD

   W = (4.4 ft^3)x(17.4 lb/ ft^3)

   W = 76.6 lb

7. $W = VD$

$V = \text{Height} \times \text{Area}$

$V = \text{Height} \times \pi\text{Radius}^2$ or $\text{Height} \times \pi x(1/2 \text{ Diameter})^2$

$V = (4 \text{ ft}) \times (\pi x(1/2x24 \text{ ft})^2)$

$V = 1809.557 \text{ ft}^3$

$V = (1809.557 \text{ ft}^3)x(7.481 \text{ gal/ft}^3)$

$V = 13{,}537.299 \text{ gal}$

$W = (13537.299 \text{ gal})x(8.354 \text{ lb/gal})$

$W = 113{,}091 \text{ lb}$

8. $D = W/V$

$V = (8.5 \text{ in})x(11 \text{ in})x(2 \text{ in})$

$V = 187 \text{ in}^3$

$W = (5 \text{ lb})x(16 \text{ oz/lb})$

$W = 80 \text{ oz}$

$D = (80 \text{ oz})/(187 \text{ in}^3)$

$D = 0.4 \text{ oz/in}^3$

9. $V = W/D$

$V = (453.6 \text{ g})/0.0025 \text{ g/cm}^3)$

$V = 181{,}440 \text{ cm}^3$

$V = (181{,}440 \text{ cm}^3)(1/28{,}317 \text{ ft}^3/\text{cm}^3)$

$V = 6.4 \text{ ft}^3)$

10. Weight:

Concrete mix: 80 lb (given)

Water:

(4 L) x (1000 g/L) x (1/453.6 lb/g) = 8.82 lb

Total:

80 lb + 8.82 lb = 88.82 lb

Volume:

Concrete mix: 0.53 ft^3 (given)

Water:

(4 L) x (0.03531 ft3/L) = 0.14 ft^3

Total:

0.53 ft^3 + 0.14 ft^3 = 0.67 ft^3

Density:

D = W/V

D = 88.82 lb/0.67 ft^3

D = 132.57 lb/ft^3

S5 LESSON: FLO SCI ENG Formats

Numbers can be expressed in three different formats:

FLO or Floating Point is the format you are familiar with.

64327.59 is an example.

Of course you know this is the same as:
$6x10^4+4x10^3+3x10^2+2x10^1+7x10^0+5x10^{-1}+9x10^{-2}$

And, $10^0 = 1$, $10^{-n} = 1/10^n$

Now we can also express this number is what is called **SCI or scientific format**

$64327.59 = 6.432759 \times 10^4$

Or in **ENG or engineering format**

$64327.59 = 64.32759 \times 10^3$

In the ENG format you will always have 10 to an exponent that is a multiple of 3. You'll see why this is when we study Prefixes in another lesson.

SCI and ENG notations are sometimes used in documentation and you can always convert from one to the other with our calculator or to FLO if the number is not too large.

However, for very large or very small numbers, SCI or ENG formats are necessary.

Frankly, if you are going to be working with very large or very small numbers you will probably be using a computer and much more powerful tools than a calculator.

It is easy to use scientific notation with a tool like Wolfram Alpha.

However, you may occasionally see them with the calculator if you multiply or divide large numbers or use the y^x key with large exponents.

$12^{21} = 4.6x10^{22}$

Now multiply by 9^{13}

$1.169x10^{35} = 1.169388422x10^{35}$

Also, the largest exponent of 10 the calculator will accept is 99.

109^85   error

But, WA handles it just fine.

S5E

FLO SCI ENG Formats

Using your calculator, convert the following numbers to both SCI and ENG.

1. 640873.26 =

2. 2347168.002 =

3. 0.0002547 =

Using your calculator, convert the following numbers to both SCI and ENG, fixing each to the number digits past the decimal point as indicated.

4. 54178962.3 (3 digits past the decimal point) =

5. 214697.0045 (2 digits past the decimal point) =

6. 145879125 (4 digits past the decimal point) =

Using your calculator, calculate the following numbers. If you receive an error message, use Wolfram Alpha.

7. $15^{26}x2^{23}$ =

8. $26^{56}x32^{54}$ =

9. $45^{-23}x16^{-13}$ =

10. $18.45^{-56}x46.78^{-24}$ =

S5EA

FLO SCI ENG Formats Answers: [ ]'s

1. 640873.26 = [**SCI = 6.4087326×10^{5}; ENG = 640.87326×10^{3}**]

2. 2347168.002 = [**SCI = $2.347168002 \times 10^{6}$; ENG = $2.347168002 \times 10^{6}$**]

3. 0.0002547 = [**SCI = 2.547×10^{-4}; ENG = 254.7×10^{-6}**]

4. 54178962.3 (3 digits past the decimal point) =
   [**SCI = 5.418×10^{7}; ENG = 54.179×10^{6}**]

5. 214697.0045 (2 digits past the decimal point) =
   [**SCI = 2.15×10^{5}; ENG = 214.70×10^{3}**]

6. 145879125 (4 digits past the decimal point) =
   [**SCI = 1.4588×10^{8}; ENG = 145.8791×10^{6}**]

7. $15^{26} \times 2^{23}$ = [**4.0331166×10^{34}**]

8. $26^{56} \times 32^{54}$ = [**Error**
   WA **26^56x32^54**
   $3.28553665 \times 10^{160}$]

9. $45^{-23} \times 16^{-13}$ = [**$2.101611366 \times 10^{-54}$**]

10. $18.45^{-56} \times 46.78^{-24}$ =
    [**Interestingly, the calculator says "0" instead of "Error"**
    WA **18.45^-56x46.78^-24**
    $1.053799609 \times 10^{-111}$]

S5A LESSON: FLO SCI ENG Formats Addendum

As we learned in S5, numbers can be expressed in three different formats.

FLO or Floating Point is the format you are familiar with.
64327.59 is an example.

SCI or scientific format
$64327.59 = 6.432759 \times 10^4$

ENG or engineering format
$64327.59 = 64.32759 \times 10^3$

What we haven't learned yet is how to enter a number in a SCI or ENG format into the calculator.

It is very easy. You just use the EE Key.

To enter 6.432759×10^4:

Just enter 6.432759 and Press the EE key,

Then enter 4, and you are done.

Now you can change it into any other format, and also you can save it in memory and the recall it in this format.

Similar for ENG format:

Just enter 64.32759 and Press EE, and then enter 3

You can also enter negative numbers.

Just press the + <-> - key before you press the EE Key.

6.432759 + <-> - EE 3

Enters the negative of this number

You can also enter a negative exponent by just pressing the + <-> - key before entering the exponent.

6.432 EE + <-> - 4

Enters $6.432x10^{-4}$ or .00006432

Of course, you could also enter

$-6.432x10^{-5}$ or -.00006432

6.432 + <-> - EE 5 + <-> -