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# Powers and Exponents

Write the power as a product.

$$8^5 = 8 \cdot 8 \cdot 8 \cdot 8 \cdot 8$$

Evaluate the expression

$$4^3 = 4 \cdot 4 \cdot 4 = 64$$

Write the Product in exponential Form

$$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 = 7^5$$

# Scientific Notation ↔ Standard Form

Write the # in Standard Form

1)  $1.5 \times 10^7 = 15,000,000$

2)  $2.39 \times 10^{12} = 2,390,000,000,000$

3)  $8 \times 10^6 = 8,000,000$

4)  $3.9 \times 10^{-7} = .00000039$

Write each # in scientific notation

1)  $12,300,000 = 1.23 \times 10^7$

↑ must be greater than or equal to 1 and less than 10

2)  $390,000 = 3.9 \times 10^5$

3)  $500,000,000,000 = 5 \times 10^{11}$

4)  $.00000059 = 5.9 \times 10^{-7}$

# Squares and Square Roots

Example of squares of numbers:

$$1.) 4^2 = 4 \cdot 4 = 16$$

$$2.) 11^2 = 11 \cdot 11 = 121$$

$$3.) (-3)^2 = -3(-3) = 9$$

---

Examples of Square Roots:

$$1.) \sqrt{25} = 5$$

$$2.) \sqrt{900} = 30$$

$$3.) -\sqrt{625} = -25$$

$$4.) \sqrt{50} = 7.1 \text{ (tenths)} \leftarrow \text{Use a calculator}$$

# Order of Operations

1. Parentheses

2. Exponents

3. Multiply/Divide from left to right

4. Add/Subtract from left to right

Please Exuse My Dear Aunt Sally

Ex. 1  $8 - 3 \cdot 2 + 7$

$$8 - 6 + 7$$

$$2 + 7$$

$$9$$

Ex. 2  $36 \div (1 + 2)^2$

$$36 \div 3^2$$

$$36 \div 9$$

$$4$$

# Evaluating Expressions

Ex. 1 Evaluate  $x+7$ , when  $x=4$

$x+7$  ← write the expression

$4+7$  ← substitute

$11$  ← evaluate

Ex. 2 Evaluate  $9a-3b$ , when  $a=4, b=3$

$9a-3b$  ← write the expression

$9 \cdot 4 - 3 \cdot 3$  ← substitute

$36-9$

$27$  ← evaluate

Ex. 3 Evaluate  $\frac{x+3}{y+1}$ , when  $x=18$ , and  $y=2$

$\frac{x+3}{y+1}$  ← write the expression

$\frac{18+3}{2+1}$  ← Substitute

$\frac{6}{3}$

$2$  ← evaluate

Ex. 4 Evaluate  $M^3-n^2$ , when  $m=3, n=4$

$M^3-N^2$  ← Write the expression

$3^3-4^2$  ← Substitute

$27-16$

$11$  ← Evaluate

# Algebraic Properties

## Distributive Property

$$\begin{array}{ccc} \begin{array}{c} \text{6} \curvearrowright \text{(3+2)} \\ \text{6} \cdot \text{3} + \text{6} \cdot \text{2} \\ 18 + 12 \\ 30 \end{array} & \begin{array}{c} \text{(7-2)} \curvearrowright \text{3} \\ \text{7} \cdot \text{3} - \text{3} \cdot \text{2} \\ 21 - 6 \\ 15 \end{array} & \begin{array}{c} \text{a} \curvearrowright \text{(b+c)} \\ \text{ab} + \text{ac} \end{array} \end{array}$$

## Commutative Property

$$3+5=5+3$$

$$a+b=b+a$$

$$7 \cdot 8 = 8 \cdot 7$$

$$xy = yx$$

## Associative Property

$$3+(4+5)=(3+4)5$$

$$a+(b+c)=(a+b)c$$

$$3 \cdot (4 \cdot 5) = (3 \cdot 4) \cdot 5$$

$$a \cdot (b \cdot c) = (a \cdot b) \cdot c$$

## Identity Property

$$7+0=7$$

$$x+0=x$$

$$7 \cdot 1=7$$

$$x \cdot 1=x$$

# Sequences

Arithmetic Sequence (Addition)

Ex. 7, 10, 13, 16

+3 +3 +3

Geometric Sequence (Multiplication)

Ex 2, 4, 8, 16, 32

x2 x2 x2 x2

# Functions

Create a function table. Then identify the domain and range.

1)  $y = 3x$

2)  $y = x - 3$

$x$	$3x$	$y$
0	$3 \cdot 0$	0
1	$3 \cdot 1$	3
2	$3 \cdot 2$	6

$x$	$x - 3$	$y$
3	$3 - 3$	0
5	$5 - 3$	2
7	$7 - 3$	4

D:  $\{0, 1, 2\}$

D:  $\{3, 5, 7\}$

R:  $\{0, 3, 6\}$

R:  $\{0, 2, 4\}$

Write an equation for the function below

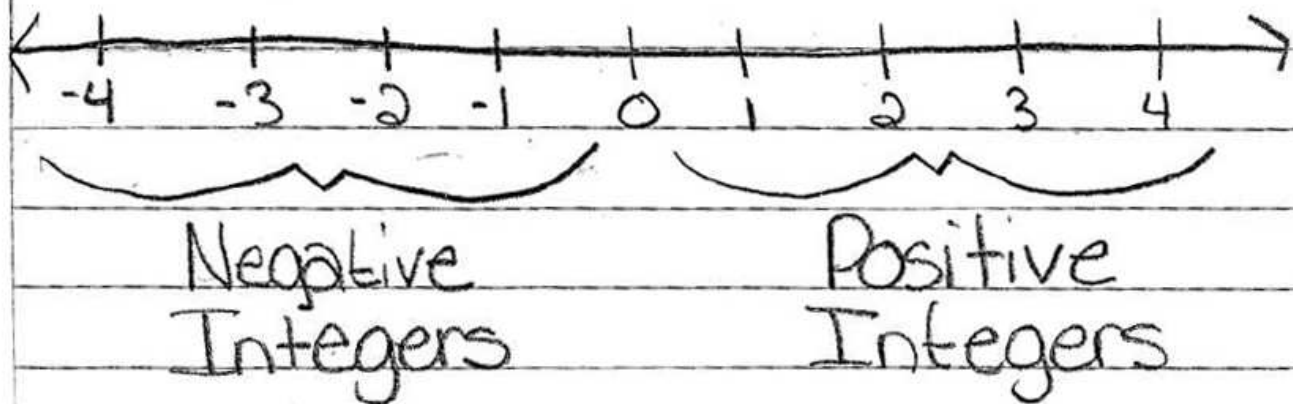
3)

$x$	$y$
0	1
1	4
2	7
3	10

$y = 3x + 1$

# Integers and Absolute Value

Integers	Not Integers
1 3	3.8 124.93
0	
7 10	$\frac{1}{2}$ $\frac{2}{3}$ $\frac{12}{7}$ $\pi$
-8 -3	-7.2 $-3\frac{7}{8}$ $\sqrt{7}$
-55	



**Evaluate each expression.**

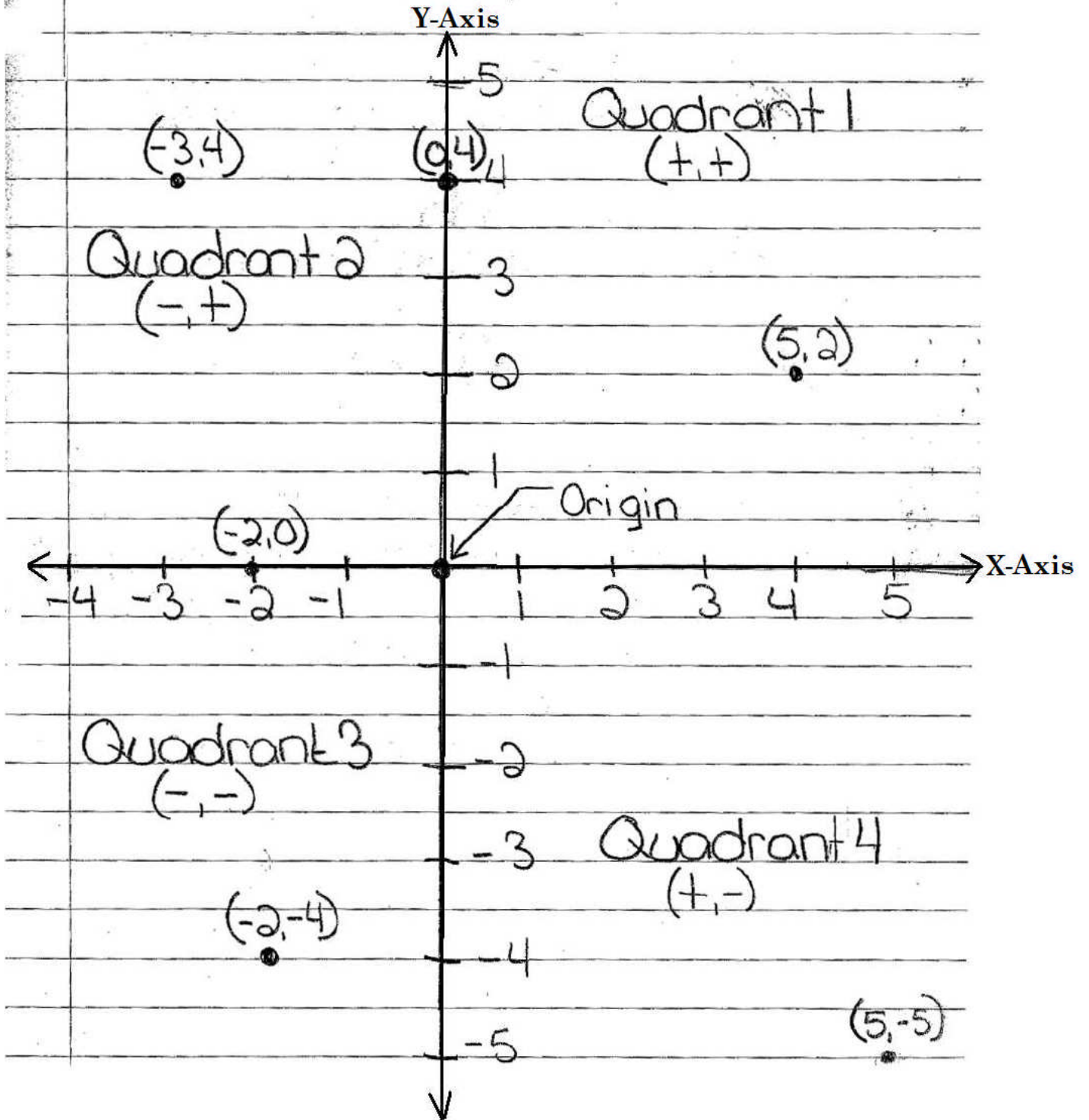
Ex. 1  $|-3| = 3$

Ex. 3  $|-35| - |20|$   
 $35 - 20$

Ex. 2  $|17| = 17$

(15)

# Coordinate Plane



## Adding Integers

Same Sign (SS)  $\rightarrow$  Add  $\rightarrow$  Keep Sign

or

Different Sign (DS)  $\rightarrow$  Subtract  $\rightarrow$  Original Sign of  
Larger Absolute Value

$$\textcircled{1} -10 + (-15) \text{ SS} \\ -25$$

$$\textcircled{2} -21 + 10 \text{ DS} \\ -11$$

$$\textcircled{3} 18 + (-9) \text{ DS} \\ 9$$

$$\textcircled{4} -3 + (-22) \text{ SS} \\ -25$$

Evaluate each expression if  $x = -5$ ,  $y = -12$ ,  
and  $z = 8$ .

$$\textcircled{5} x + y \\ -5 + (-12) \text{ SS} \\ -17$$

$$\textcircled{6} y + z \\ -12 + 8 \text{ DS} \\ -4$$

## Subtracting Integers

$$\textcircled{1} \quad -3 - 8 \quad \text{SS} \\ -11$$

$$\textcircled{2} \quad 12 - 15 \quad \text{DS} \\ -3$$

$$\textcircled{3} \quad \begin{array}{c} \downarrow \\ -5 - (-8) \quad \text{DS} \\ 3 \end{array}$$

$$\textcircled{4} \quad \begin{array}{c} \downarrow \\ 9 - (-6) \quad \text{SS} \\ 15 \end{array}$$

Evaluate each expression if  $x = -5$ ,  $y = -10$ , and  $z = 6$

$$\textcircled{5} \quad \begin{array}{c} x - z \\ -5 - 6 \quad \text{SS} \\ -11 \end{array}$$

$$\textcircled{6} \quad \begin{array}{c} y - x \\ -10 - (-5) \quad \text{DS} \\ -5 \end{array}$$

# Multiplying and Dividing Integers

1) Multiply or Divide absolute values of each number

2) Count # of negative signs

→ Even amount, answer is (+)

→ Odd amount, answer is (-)

$$\textcircled{1} \quad -8(-2) \text{ Even}$$
$$16$$

$$\textcircled{2} \quad 3(-5) \text{ Odd}$$
$$-15$$

$$\textcircled{3} \quad -24 \div 6 \text{ Odd}$$
$$-4$$

$$\textcircled{4} \quad -120 \div (-3) \text{ Even}$$
$$40$$

Evaluate each expression if  $a = -5$ ,  $b = -10$ ,  $c = 2$

$$\textcircled{5} \quad 5ac$$

$$5(-5)(2)$$

$$\boxed{-50}$$

$$\textcircled{6} \quad b^2 - 2a$$

$$(-10)^2 - 2(-5)$$

$$100 - 2(-5)$$

$$100 - (-10)$$

$$\boxed{110}$$

$$\textcircled{7} \quad \frac{a+b}{3}$$

$$3$$

$$\frac{-5 + (-10)}{3}$$

$$3$$

$$\frac{-15}{3} = \boxed{-5}$$

# Solving Addition and Subtraction Equations

$$\begin{array}{r} \textcircled{1} \quad x + 8 = 12 \\ \quad -8 \quad -8 \\ \hline \quad \quad x = 4 \end{array}$$

$$\begin{array}{r} \textcircled{2} \quad y - 3 = 12 \\ \quad \quad +3 \quad +3 \\ \hline \quad \quad y = 15 \end{array}$$

$$\begin{array}{r} \textcircled{3} \quad x + 9 = -4 \\ \quad -9 \quad -9 \\ \hline \quad \quad x = -13 \end{array}$$

$$\begin{array}{r} \textcircled{4} \quad m - 10 = -3 \\ \quad \quad +10 \quad +10 \\ \hline \quad \quad m = 7 \end{array}$$

$$\begin{array}{r} \textcircled{5} \quad -2 = p + 7 \\ \quad -7 \quad -7 \\ \hline \quad -9 = p \end{array}$$

$$\begin{array}{r} \textcircled{6} \quad -6 + n = 5 \\ \quad \quad +6 \quad +6 \\ \hline \quad \quad n = 11 \end{array}$$

$$\begin{array}{r} \textcircled{7} \quad -12 = 4 + y \\ \quad -4 \quad -4 \\ \hline \quad -16 = y \end{array}$$

$$\begin{array}{r} \textcircled{8} \quad -3 = b - 1 \\ \quad \quad +1 \quad +1 \\ \hline \quad -2 = b \end{array}$$

# Solving Multiplication Equations

$$1. \frac{2x}{2} = \frac{20}{2}$$
$$x = 10$$

$$2. \frac{-3d}{-3} = \frac{18}{-3}$$
$$d = -6$$

$$3. \frac{-20}{4} = \frac{4m}{4}$$
$$-5 = m$$

$$4. \frac{-30}{-5} = \frac{-5r}{-5}$$
$$6 = r$$

# Solving Two-Step Equations

$$1. 2x - 7 = 5$$

$$+7 \quad +7$$

$$\underline{2x = 12}$$

$$\frac{2}{2} \quad \frac{2}{2}$$

$$x = 6$$

$$2. -4 = -3d + 20$$

$$\underline{-20 \quad -20}$$

$$-24 = -3d$$

$$\frac{-24}{-3} \quad \frac{-3d}{-3}$$

$$8 = d$$

$$3. 13 = -17 - 5m$$

$$\underline{+17 \quad +17}$$

$$30 = -5m$$

$$\frac{30}{-5} \quad \frac{-5m}{-5}$$

$$-6 = m$$

$$4. -11b - 5 = -104$$

$$\underline{+5 \quad +5}$$

$$\underline{-11b = -99}$$

$$\frac{-11b}{-11} \quad \frac{-99}{-11}$$

$$b = 9$$

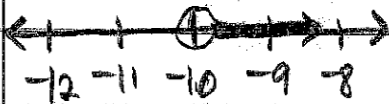
# Linear Inequalities

Solve and graph each inequality.

$$1) x + 7 > -3$$

$$\underline{-7 \quad -7}$$

$$x > -10$$



$$2) -8 \geq m - 12$$

$$\underline{+12 \quad +12}$$

$$4 \geq m$$



$$3) 3y + 8 < -4$$

$$\underline{-8 \quad -8}$$

$$\underline{\frac{3y}{3} < \frac{-12}{3}}$$

$$y < -4$$



$$4) -2p + 7 \geq 3$$

$$\underline{-7 \quad -7}$$

$$\underline{\frac{-2p}{-2} \geq \frac{-4}{-2}}$$

$$p \leq 2$$



The direction of the inequality symbol is reversed when multiplying or dividing by a negative #

## Using Formulas

### 3-Step Process

- 1) Write down the formula or equation
- 2) Substitute
- 3) Solve

## **ISTEP + Mathematics Reference Sheet**









Figure	Formulas for Area (A) and Circumference (C)	
Triangle 	$A = \frac{1}{2}bh$	Area = $\frac{1}{2}$ × base × height
Rectangle 	$A = lw$   $P = 2L + 2W$	Area = length × width
Trapezoid 	$A = \frac{1}{2}h(b_1 + b_2)$	Area = $\frac{1}{2}$ × height × sum of bases
Parallelogram 	$A = bh$	Area = base × height
Square 	$A = s^2$	Area = side × side
Circle 	$A = \pi r^2$ $C = 2\pi r$	Area = $\pi$ × square of radius Circumference = $2 \times \pi \times$ radius $\pi \approx 3.14$ or $\frac{22}{7}$

Figure	Formulas for Volume (V) and Surface Area (SA)	
Rectangular Prism 	$V = lwh$ $SA = 2lw + 2hw + 2lh$	Volume = length × width × height Surface Area = $2(\text{length} \times \text{width}) + 2(\text{height} \times \text{width}) + 2(\text{length} \times \text{height})$
Cylinder 	$V = \pi r^2 h$ $SA = 2\pi r^2 + 2\pi rh$	Volume = $\pi$ × square of radius × height Surface Area = $2 \times \pi \times$ square of radius + $2 \times \pi \times$ radius × height

# Literal Equations

Solve each literal equation for the indicated variable.

$$1) \frac{A}{h} = \frac{bh}{h}, \text{ for } b$$

$$\frac{A}{h} = b \text{ or } b = \frac{A}{h}$$

$$2) \begin{array}{r} -5A + 6B = 13, \text{ for } B \\ +5A \qquad +5A \end{array}$$

$$\frac{6B}{6} = \frac{5A+13}{6}$$

$$B = \frac{5A+13}{6}$$

$$3) \begin{array}{r} 3x + 5y = 2z - 3, \text{ for } y \\ -3x \qquad -3x \end{array}$$

$$\frac{5y}{5} = \frac{-3x+2z-3}{5}$$

$$y = \frac{-3x+2z-3}{5}$$

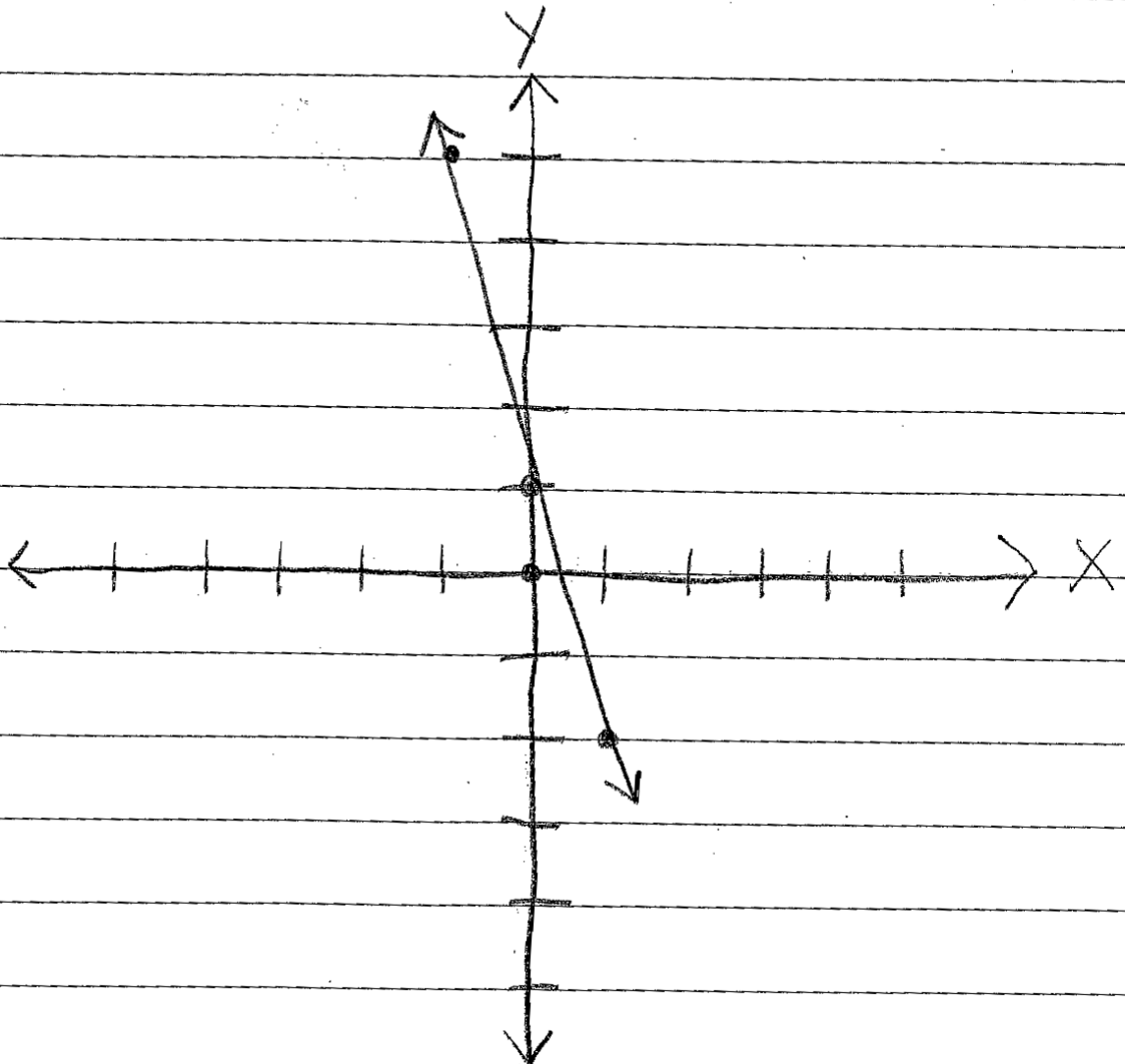
# Graphing Functions

Ex. Graph  $y = -3x + 1$

Domain  $\{-1, 0, 1\}$

Range  $\{4, 1, -2\}$

x	$-3x + 1$	y	
-1	$-3(-1) + 1$	4	$(-1, 4)$
0	$-3(0) + 1$	1	$(0, 1)$
1	$-3(1) + 1$	-2	$(1, -2)$



# Prime Factorization

Prime numbers: contains only 2 factors, one and itself

Examples → 5, 13, 2, 7, 23

Composite number: contains more than 2 factors

Examples → 4, 9, 28, 45, 33.

Factors of 12:

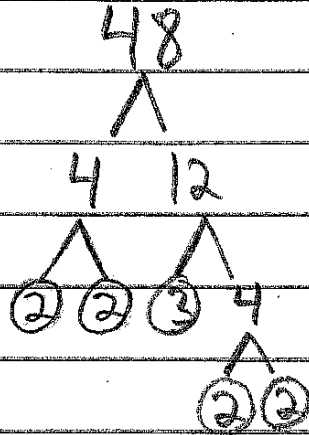
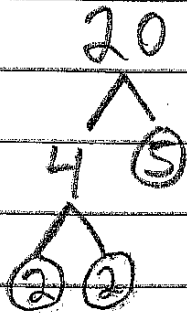
12 → 1, 2, 3, 4, 6, 12

Find the prime factorization of each number

$48$	$\checkmark 48 = 2^4 \cdot 3$	$200x^3y^2$	
^		^	$200x^3y^2 =$
8 6		20 10	$2^3 \cdot 5^3 \cdot x^3 \cdot$
^ ^		^ ^	$y^2$
4 (2)(2)(3)		4 (5)(5)(2)	
^		^ ^	
(2)(2)		(2)(2)	

# Greatest Common Factor

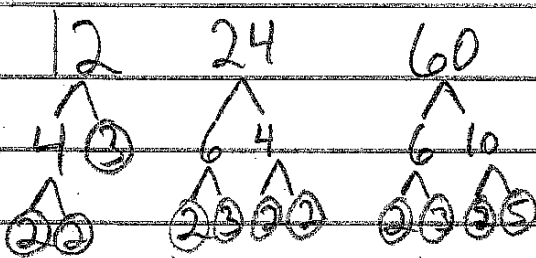
1) Find the GCF of 20 and 48.



$$20 = 2 \cdot 2 \cdot 5$$
$$48 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$$

$$\text{GCF} = 2 \cdot 2 = 4$$

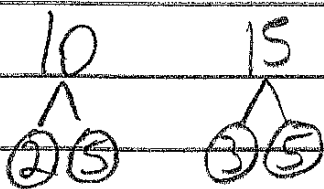
2) Find the GCF of 12, 24, and 60.



$$12 = 2 \cdot 2 \cdot 3$$
$$24 = 2 \cdot 2 \cdot 2 \cdot 3$$
$$60 = 2 \cdot 2 \cdot 3 \cdot 5$$

$$\text{GCF} = 2 \cdot 2 \cdot 3 = 12$$

3) Find the GCF of  $10x^2y$  and  $15xy^3$



$$10x^2y = 2 \cdot 5 \cdot x \cdot x \cdot y$$
$$15xy^3 = 3 \cdot 5 \cdot x \cdot y \cdot y \cdot y$$

$$\text{GCF} = 5xy$$

# Simplifying Fractions

$$1) \frac{8 \div 4}{28 \div 4} = \frac{2}{7}$$

↑  
GCF

$$2) \frac{180 \div 10}{200 \div 10} = \frac{18 \div 2}{20 \div 2} = \frac{9}{10}$$

$$3) \frac{75 \div 5}{105 \div 5} = \frac{15 \div 3}{21 \div 3} = \frac{5}{7}$$

$$4) \frac{81 \div 9}{144 \div 9} = \frac{9}{16}$$

## Fractions $\leftrightarrow$ Decimals

Write each fraction or mixed number as a decimal.

$$1) \frac{7 \times 5}{20 \times 5} = \frac{35}{100} = \boxed{.35} \quad 2) 5 \frac{7 \times 2}{50 \times 2} = 5 \frac{14}{100} = \boxed{5.14}$$

$$3) 4 \frac{7}{8} = \boxed{4.875} \quad 4) 6 \frac{9}{22} = \boxed{6.409}$$

$$\begin{array}{r} .875 \\ 8 \overline{) 7.00} \\ \underline{-64} \phantom{00} \\ 60 \phantom{00} \\ \underline{-56} \phantom{00} \\ 40 \phantom{00} \\ \underline{-40} \phantom{00} \\ 0 \end{array}$$

$$\begin{array}{r} .409 \\ 22 \overline{) 9.000} \\ \underline{-88} \phantom{000} \\ 20 \phantom{00} \\ \underline{-20} \phantom{00} \\ 200 \phantom{00} \\ \underline{-198} \phantom{00} \\ 2 \end{array}$$

Write each decimal as a fraction or mixed number  
in simplest form.

$$5) 0.24 = \frac{24 \div 4}{100 \div 4} = \boxed{\frac{6}{25}}$$

$$6) 13.004 = 13 \frac{4 \div 4}{1000 \div 4} = \boxed{13 \frac{1}{250}}$$

## Fraction $\leftrightarrow$ Percent

1) Write  $\frac{7}{20}$  as a percent.

$$\frac{7}{20} = \frac{35}{100} = 35\%$$

2) Write  $\frac{3}{5}$  as a percent

$$\frac{3}{5} = \frac{60}{100} = 60\%$$

3) Write 48% as a fraction in simplest form.

$$48\% = \frac{48 \div 4}{100 \div 4} = \frac{12}{25}$$

4) Write 65% as a fraction in simplest form.

$$65\% = \frac{65 \div 5}{100 \div 5} = \frac{13}{20}$$

# Percent ↔ Decimal

Write each percent as a decimal number.

$$1.) 23\% = \frac{23}{100} = 0.23$$

$$2.) 34.8\% = 0.348$$

$$3.) 32\frac{1}{2}\% = 32.5\% = .325$$

$$4.) 9.44\% = 0.0944$$

Divide by 100  
(move back  
two spots)

Write each decimal number as a percent.

$$1.) 0.95 = 95\%$$

$$2.) 0.347 = 34.7\%$$

$$3.) 0.0811 = 8.11\%$$

$$4.) 0.555 = 55.5\%$$

Multiply by 100  
(move forward  
two spots)

# Least Common Multiple

Find the LCM of each set of numbers.

1) 30 and 45

Method #1 (List Multiples)

$$30 \rightarrow 30, 60, 90$$

$$45 \rightarrow 45, 90$$

$$\text{LCM} = 90$$

Method #2 (Prime Factorization)

$$30 = 2 \cdot 3 \cdot 5$$

$$45 = 3^2 \cdot 5$$

$$\text{LCM} = 2 \cdot 3^2 \cdot 5 = 90$$

2) 12, 16, and 36

Method #1

$$12 \rightarrow 12, 24, 36, 48, 60, 72, 84, 96, 108, 120, 132, 144$$

$$16 \rightarrow 16, 32, 48, 64, 80, 96, 112, 128, 144$$

$$36 \rightarrow 36, 72, 108, 144$$

$$\text{LCM} = 144$$

Method #2

$$12 = 2^2 \cdot 3$$

$$16 = 2^4$$

$$36 = 2^2 \cdot 3^2$$

$$\text{LCM} = 2^4 \cdot 3^2 = 144$$

# Operations with Decimals

1)  $2.34 \times 8.1$

$$\begin{array}{r} \overset{2}{2}.\overset{3}{34} \\ \times 8.1 \\ \hline 234 \\ +18720 \\ \hline 18954 \\ \text{MN (Move to the left} \\ \text{3 spots)} \end{array}$$

3 digits to the right of the decimal points

2)  $25.8 \div 2$

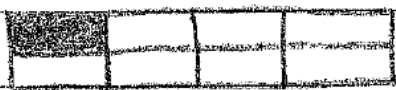
$$\begin{array}{r} \boxed{12.9} \\ 2 \overline{)25.8} \\ \underline{-2} \\ 05 \\ \underline{-4} \\ 18 \\ \underline{-18} \\ 0 \end{array}$$

3)  $199.68 \div 9.6$

$$\begin{array}{r} \boxed{20.8} \\ 9.6 \overline{)199.68} \\ \underline{-192} \\ 76 \\ \underline{-0} \\ 768 \\ \underline{-768} \\ 0 \end{array}$$

# Estimating with Fractions

Fractions Close to 0



$$\frac{1}{8} \approx 0$$

Ex.  $\frac{1}{5}, \frac{2}{15}, \frac{5}{10}, \frac{1}{11}$

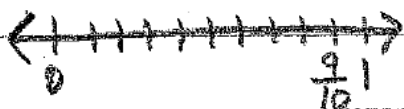
Fractions Close to  $\frac{1}{2}$



$$\frac{6}{11} \approx \frac{1}{2}$$

Ex.  $\frac{4}{7}, \frac{11}{20}, \frac{23}{51}, \frac{49}{82}$

Fractions Close to 1



$$\frac{9}{10} \approx 1$$

Ex.  $\frac{5}{6}, \frac{11}{12}, \frac{17}{19}, \frac{101}{105}$

Estimate.

$$1) \frac{1}{9} + \frac{4}{5} \approx 0 + 1 = 1$$

$$2) 8\frac{1}{8} - 3\frac{5}{9} \approx 8 - 3\frac{1}{2} = \boxed{4\frac{1}{2}}$$

$$3) 7\frac{1}{3} \times 4\frac{6}{11} \approx 7 \times 5 = \boxed{35}$$

(With  $\times$ , estimate to nearest whole number)

Estimate using compatible numbers.

$$4) \frac{1}{9} \times 28 \approx \frac{1}{9} \times 27 = \boxed{3}$$

$$5) 14\frac{1}{7} \div 4\frac{2}{3} \approx 15 \div 5 = \boxed{3}$$

# Adding and Subtracting Fractions

$$1) \frac{4}{9} + \frac{3}{9} = \frac{7}{9}$$

$$2) \frac{4}{15} + \frac{13}{15} = \frac{17}{15} = 1\frac{2}{15}$$

15 | 17  
- 15  
---  
2

$$3) \frac{7 \times 3}{8 \times 3} - \frac{1 \times 4}{6 \times 4} \quad \text{LCD} = 24$$

$$\frac{21}{24} - \frac{4}{24} = \frac{17}{24}$$

$$4) \frac{7 \times 5}{12 \times 5} + \frac{9 \times 6}{10 \times 6} \quad \text{LCD} = 60$$

$$\frac{35}{60} + \frac{54}{60} = \frac{89}{60} = 1\frac{29}{60}$$

# Adding and Subtracting Mixed Numbers

$$1) 6\frac{7}{8} + 9\frac{3}{10}$$

$$6\frac{35}{40} + 9\frac{12}{40} = 15\frac{47}{40} = \boxed{16\frac{7}{40}}$$

$$2) 10\frac{5}{8} - 3 = \boxed{7\frac{5}{8}}$$

$$3) 10 - 3\frac{5}{8}$$

$$9\frac{8}{8} - 3\frac{5}{8} = \boxed{6\frac{3}{8}}$$

$$4) 7\frac{1}{6} - 3\frac{3}{4}$$

Rename  $\rightarrow$   $\boxed{7\frac{2}{12}} - 3\frac{9}{12}$

$$6\frac{14}{12} - 3\frac{9}{12} = \boxed{3\frac{5}{12}}$$

## Multiplying Fractions and Mixed Numbers

$$1) \frac{3}{\cancel{10}_5} \cdot \frac{\cancel{2}^1}{7} = \boxed{\frac{3}{35}}$$

$$2) \frac{\cancel{3}^1}{\cancel{8}_4} \cdot \frac{\cancel{2}^1}{7} \cdot \frac{\cancel{14}^2}{\cancel{15}_3} \cdot \frac{\cancel{8}^1}{\cancel{6}_2} = \boxed{\frac{1}{12}}$$

$$3) 4\frac{1}{5} \cdot \frac{5}{14}$$
$$\overset{3}{\cancel{21}_1} \cdot \frac{\cancel{8}^1}{\cancel{14}_2} = \frac{3}{2} = \boxed{1\frac{1}{2}}$$

$$4) 9 \cdot \frac{5}{6}$$
$$\overset{3}{\cancel{9}_1} \cdot \frac{5}{\cancel{6}_2} = \frac{15}{2} = \boxed{7\frac{1}{2}}$$

$$5) 3\frac{1}{3} \cdot 2\frac{3}{4}$$
$$\overset{5}{\cancel{10}_3} \cdot \frac{11}{\cancel{4}_2} = \frac{55}{6} = \boxed{9\frac{1}{6}}$$

## Solving Multiplication and Division Equations

Find the multiplicative inverse.

$$1) 6 \rightarrow \boxed{\frac{1}{6}} \quad 2) 3\frac{2}{3} = \frac{11}{3} \rightarrow \boxed{\frac{3}{11}}$$

Solve each equation.

$$1) \frac{x}{7} = 4$$

$$7 \cdot \frac{x}{7} = 4 \cdot 7$$

$$\boxed{x = 28}$$

$$2) \frac{m}{8} = -\frac{3}{4}$$

$$8 \cdot \frac{m}{8} = -\frac{3 \cdot 8}{4 \cdot 1}$$

$$\boxed{m = -6}$$

$$3) \frac{2}{3}c = \frac{8}{11}$$

$$\frac{3}{2} \cdot \frac{2}{3}c = \frac{48}{11} \cdot \frac{3}{2}$$

$$c = \frac{12}{11} = \boxed{1\frac{1}{11}}$$

$$4) \frac{7}{10}b = 2\frac{1}{3}$$

$$\frac{10}{7} \cdot \frac{7}{10}b = \frac{17}{3} \cdot \frac{10}{7}$$

$$b = \frac{10}{3} = \boxed{3\frac{1}{3}}$$

## Dividing Fractions and Mixed Numbers

$$1) \frac{3}{11} \div \frac{21}{22} = \frac{\overset{1}{3}}{\underset{1}{11}} \cdot \frac{\overset{2}{22}}{\underset{7}{21}} = \boxed{\frac{2}{7}}$$

$$2) 8 \div \frac{3}{4} = \frac{8}{1} \cdot \frac{4}{3} = \frac{32}{3} = \boxed{10 \frac{2}{3}}$$

$$3) \frac{2}{15} \div 4 = \frac{2}{15} \div \frac{4}{1} = \frac{\overset{1}{2}}{\underset{2}{15}} \cdot \frac{1}{4} = \boxed{\frac{1}{30}}$$

$$4) 7 \frac{1}{3} \div 1 \frac{1}{6}$$

$$\frac{22}{3} \div \frac{7}{6} = \frac{22}{\underset{1}{3}} \cdot \frac{\overset{2}{6}}{7} = \frac{44}{7} = \boxed{6 \frac{2}{7}}$$

# Ratios

Examples  $\rightarrow$  3 to 4, 3:4,  $\frac{3}{4}$   
10 to 7, 10:7,  $\frac{10}{7}$   
a to b, a:b,  $\frac{a}{b}$

Write each ratio as a fraction in simplest form.

- 1) 20 boys: 12 girls      2) 35 pencils to 50 pens

$$\frac{20 \div 4}{12 \div 4} = \frac{5}{3}$$

$$\frac{35 \div 5}{50 \div 5} = \frac{7}{10}$$

Determine whether the ratios are equivalent.

- 3) 48 questions to 20 multiple choice  
36 questions to 15 multiple choice

$$\frac{48 \div 4}{20 \div 4} = \frac{12}{5}$$

$$\frac{36 \div 3}{15 \div 3} = \frac{12}{5}$$

} Yes, they are equivalent.

# Rates

Examples  $\rightarrow$  55 mph, \$25/4hr, 25.5 students/class

Find the unit rate. Round to the nearest hundredth if necessary.

1) 100 miles on 14 gallons

$$\frac{100 \text{ mi} \div 14}{14 \text{ gal} \div 14} = \boxed{\frac{7.14 \text{ mi}}{1 \text{ gal}}}$$

2) \$3.36 for 16.4 ounces

$$\frac{\$3.36 \div 16.4}{16.4 \text{ oz} \div 16.4} = \boxed{\frac{\$.20}{1 \text{ oz}}}$$

3) \$5.99 for 12-Pack of Mt. Dew

$$\frac{\$5.99 \div 12}{12 \text{ cans} \div 12} = \boxed{\frac{\$.50}{1 \text{ can}}}$$

# Rate of Change and Slope

$$m = \text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\Delta Y}{\Delta X} = \frac{\text{Change in } Y}{\text{Change in } X}$$

Find the rate of change.

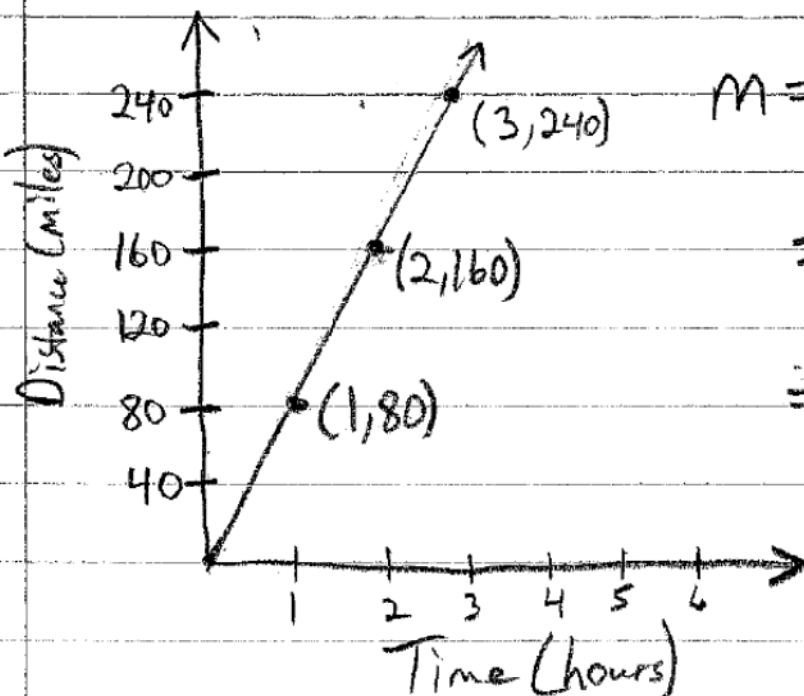
1) Cars Washed

Number	Money (\$)
5	40
10	80
15	120
20	160

$$m = \frac{\Delta Y}{\Delta X} = \frac{40}{5} = \boxed{\$8 \text{ per car}}$$

2nd column  
1st column

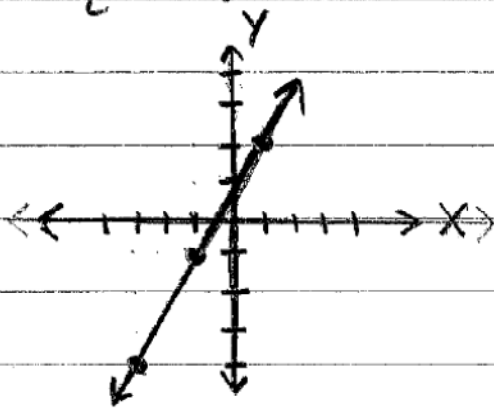
2) Distance Traveled



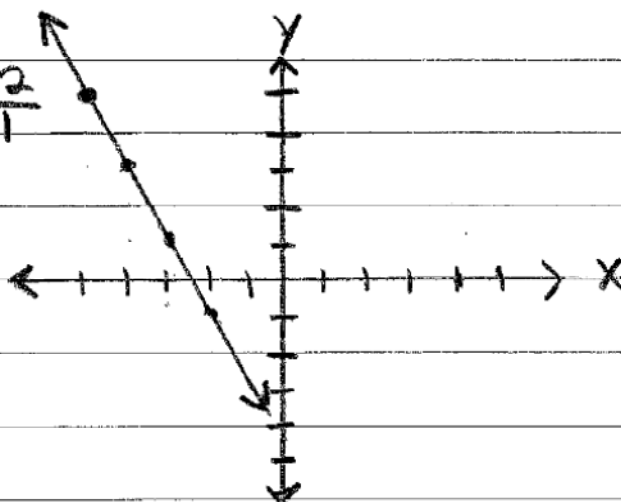
$$m = \frac{\Delta Y}{\Delta X} = \frac{240 - 160}{3 - 2} = \frac{80}{1} = \boxed{80 \text{ miles per hour}}$$

# Graphs of Linear Equations

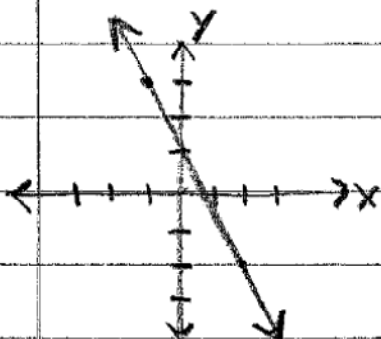
- 1) Slope =  $\frac{3}{2}$   
Point:  $(-3, -4)$



- 2) Slope =  $-2 = \frac{-2}{1}$   
Point:  $(-5, 5)$



- 3) Draw a line that passes through  $(-1, 3)$  and  $(2, -2)$ . Then find the slope.



$$m = \frac{\Delta y}{\Delta x}$$

$$= \frac{3 - (-2)}{-1 - 2}$$

$$= \frac{5}{-3} = \boxed{\frac{5}{3}}$$

- 4) Find a point on the line  $y = 4x - 1$ . Then find the slope.

$$y = 4x - 1$$

$$y = 4(1) - 1$$

$$y = 3$$

$$\boxed{(1, 3)}$$

$$y = 4x - 1$$

$$y = 4(2) - 1$$

$$y = 7$$

$$\boxed{(2, 7)}$$

$$m = \frac{\Delta y}{\Delta x}$$

$$= \frac{7 - 3}{2 - 1}$$

$$= \frac{4}{1} = \boxed{4}$$

# Direct Variation

1) Miles (x)	25	50	75	100
Gallons (y)	1	2	3	4

Determine if this is a direct variation equation  $\rightarrow \frac{1}{25} = .04$ ,  $\frac{2}{50} = .04$ ,  $\frac{3}{75} = .04$

$$\frac{4}{100} = .04$$

$$m = .04 = \frac{1}{25}$$

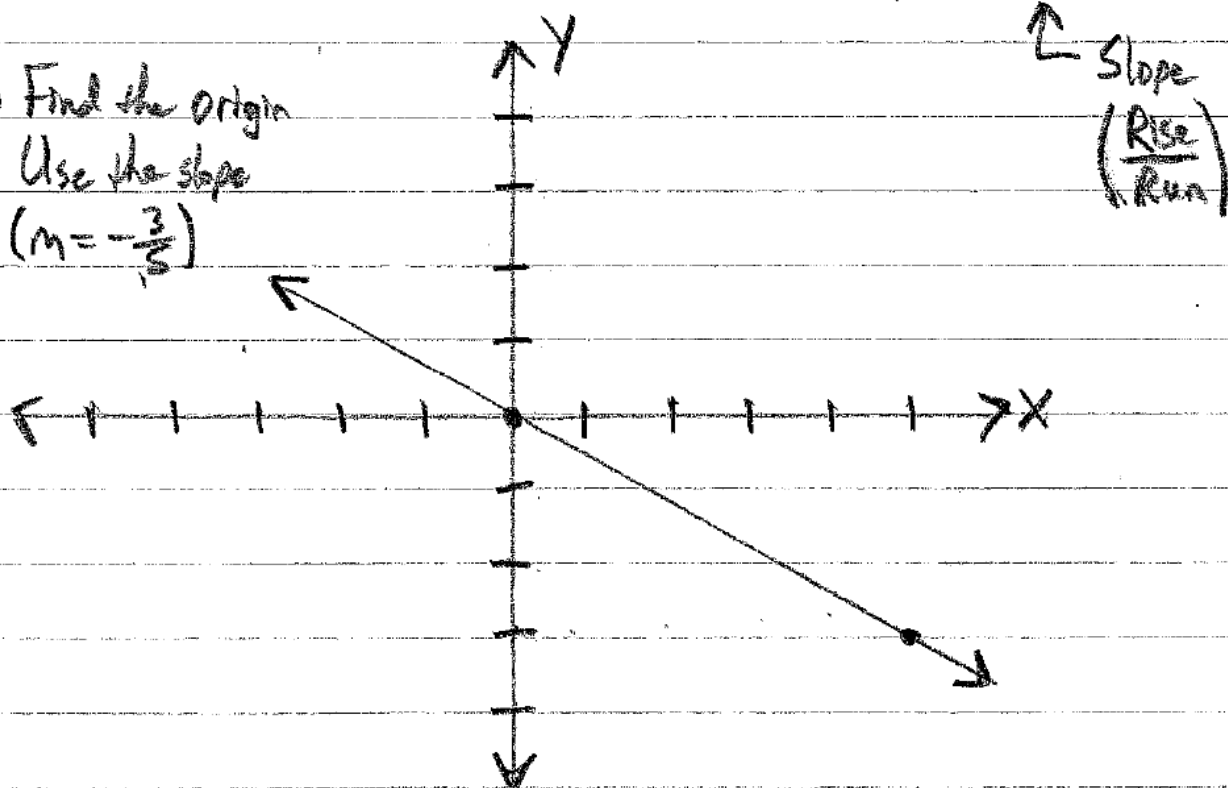
$$y = \frac{1}{25}x$$

2) Graph the direct variation equation  $y = -\frac{3}{5}x$

① Find the origin

② Use the slope

$$(m = -\frac{3}{5})$$



# Customary and Metric Units (Conversions)

	Customary	Metric	Customary $\rightarrow$ Metric
Length	1 ft = 12 in	1 km = 1,000 m	1 in $\approx$ 2.54 cm
	1 yd = 3 ft	1 m = 100 cm	1 ft $\approx$ .30 m
	1 mi = 5,280 ft	1 cm = 10 mm	1 yd $\approx$ .91 m
Capacity	1 c = 8 fl oz	1 kL = 1,000 L	1 mi $\approx$ 1.61 km
	1 pt = 2 c	1 L = 100 cL	1 c $\approx$ 236.59 mL
	1 qt = 2 pt	1 cL = 10 mL	1 pt $\approx$ 473.18 mL
	1 gal = 4 qt		1 qt $\approx$ 946.35 mL
Weight	1 lb = 16 oz	1 kg = 1,000 g	1 gal $\approx$ 3.79 L
	1 T = 2,000 lb	1 g = 100 cg	1 lb $\approx$ 453.6 g
		1 cg = 10 mg	1 lb $\approx$ .4536 kg
			1 T $\approx$ 907.2 kg

1) 15 ft = ? in      2) 10 c = ? gal

$$\frac{15 \cancel{\text{ft}}}{1} \cdot \frac{12 \text{ in}}{1 \cancel{\text{ft}}} = \boxed{180 \text{ in}}$$

$$\frac{10 \cancel{\text{c}}}{1} \cdot \frac{1 \cancel{\text{pt}}}{2 \cancel{\text{c}}} \cdot \frac{1 \cancel{\text{qt}}}{2 \cancel{\text{pt}}} \cdot \frac{1 \text{ gal}}{4 \cancel{\text{qt}}} = \boxed{\frac{5}{8} \text{ gal}}$$

3) 8.3 kg = ? lb

$$\frac{8.3 \cancel{\text{kg}}}{1} \cdot \frac{1 \text{ lb}}{.4536 \cancel{\text{kg}}} \approx \frac{8.3}{.4536} \text{ lb} \approx \boxed{18.30 \text{ lb}}$$

(Round-Hundredths)

# Proportions

Determine if the quantities in each pair of ratios are proportional.

1) 10 boys for 15 girls and 14 boys for 21 girls

Method #1

$$\left. \begin{array}{l} \frac{10 \div 5}{15 \div 5} = \frac{2}{3} \\ \frac{14 \div 7}{21 \div 7} = \frac{2}{3} \end{array} \right\} \text{Yes}$$

Method #2

$$\begin{array}{l} \frac{10 \times 21}{15 \times 14} \\ 10 \cdot 21 \stackrel{?}{=} 15 \cdot 14 \\ 210 = 210 \checkmark \text{ Yes} \end{array}$$

Solve each proportion.

$$\begin{array}{l} 2) \quad \frac{7 \times 3}{x \times 6} \\ 3 \cdot x = 7 \cdot 6 \\ \frac{3x}{3} = \frac{42}{3} \\ \boxed{x = 14} \end{array}$$

$$\begin{array}{l} 3) \quad \frac{2.5}{4.5} = \frac{7.5}{x} \\ (2.5)x = (4.5)(7.5) \\ \frac{2.5x}{2.5} = \frac{33.75}{2.5} \\ \boxed{x = 13.5} \end{array}$$

# Fractions and Percents

Write each percent as a fraction in simplest form.

$$1) 32.5\% = \frac{32.5 \times 10}{100 \times 10} = \frac{325 \div 5}{1,000 \div 5} = \frac{65 \div 5}{200 \div 5} = \boxed{\frac{13}{40}}$$

$$2) 6\frac{1}{4}\% = \frac{6\frac{1}{4}}{100} = 6\frac{1}{4} \div 100 = \frac{25}{4} \div \frac{100}{1}$$
$$= \frac{25}{4} \cdot \frac{1}{100} = \boxed{\frac{1}{16}}$$

Write each fraction as a percent. Round to the nearest hundredth if necessary.

$$3) \frac{120}{25} \rightarrow \frac{n}{100}$$

$$\frac{25n}{25} = \frac{12000}{25}$$

$$\boxed{n = 480\%}$$

$$4) \frac{16}{21} \rightarrow \frac{n}{100}$$

$$\frac{21n}{21} = \frac{1600}{21}$$

$$\boxed{n = 76.19\%}$$

# Percent of a Number

1) Find 80% of 20.

Method #1

$$\frac{\overset{16}{80}}{\underset{5}{100}} \cdot \frac{\overset{1}{20}}{1} = \frac{16}{1} = \boxed{16}$$

Method #2

$$80\% \times 20 = (.8)(20) = \boxed{16}$$

2) Find 120% of 75.

Method #1

$$\frac{\overset{30}{120}}{\underset{4}{100}} \cdot \frac{\overset{3}{75}}{1} = \frac{90}{1} = \boxed{90}$$

Method #2

$$120\% \times 75 = (1.2)(75) = \boxed{90}$$

3) Find 47.8% of 89. Round to the nearest tenth.

$$47.8\% \times 89 = (.478)(89) = \boxed{42.5}$$

# The Percent Proportion

Formula:  $\frac{a}{b} = \frac{P}{100}$

Part  $\uparrow$  base

$\rightarrow a$  - Percent  $\leftarrow$

$$\left( \frac{\text{is}}{\text{of}} = \frac{\%}{100} \right)$$

Ex. 1 What percent of 60 is 15?

$$\frac{a}{b} = \frac{P}{100}$$

$$\frac{15}{60} = \frac{P}{100}$$

$$\frac{100P}{60} = \frac{1500}{60}$$

$$P = 25\%$$

Ex. 2 75 is 25% of what number?

$$\frac{a}{b} = \frac{P}{100}$$

$$\frac{75}{b} = \frac{25}{100}$$

$$25b = 7500$$

$$25 \quad 25$$

$$b = 300$$

Ex. 3 What number is 32% of 28?

$$\frac{a}{b} = \frac{P}{100}$$

$$\frac{a}{28} = \frac{32}{100}$$

$$100a = 896$$

$$100 \quad 100$$

$$a = 8.96$$

# Percent Estimation

$$10\% \text{ of } 80 = 8$$

$$10\% \text{ of } 120 = 12$$

$$10\% \text{ of } 980 = 98$$

Estimate.

1)  $77\% \text{ of } 48$

2)  $28\% \text{ of } 62$

$$80\% \text{ of } 50$$

$$30\% \text{ of } 60$$

$$10\% \text{ of } 50 = 5$$

$$10\% \text{ of } 60 = 6$$

$$5 \times 8 = \boxed{40}$$

$$6 \times 3 = \boxed{18}$$

3)  $21.2\% \text{ of } 92$

$$20\% \text{ of } 90$$

$$10\% \text{ of } 90 = 9$$

$$9 \times 2 = \boxed{18}$$

# The Percent Equation

Ex. 1, What number is 12% of 350?

$$x = .12 \cdot 350$$

$$x = (.12)(350)$$

$$x = 42$$

---

Ex. 2, 21 is what percent of 40?

$$21 = x \cdot 40$$

$$21 = x \cdot 40$$

$$21 = 40x$$

$$40 \quad 40$$

$$525 = x$$

$$x = 52.5\%$$

---

Ex. 3, 13 is 26% of what number?

$$13 = .26 \cdot x$$

$$13 = .26 \cdot x$$

$$.26 \quad .26$$

$$50 = x$$

# Percent of Change

$$\frac{\text{percent of change}}{\text{change}} = \frac{\text{amount of change}}{\text{original amount}}$$

Find the percent of change. Round to the nearest tenth.

Ex. 1 Original: \$8.42/hr  
New: \$9.57/hr

$$\begin{aligned} \% \text{ of Inc.} &= \frac{\text{amt. of change}}{\text{orig. amt.}} \\ &= \frac{9.57 - 8.42}{8.42} \\ &= \frac{1.15}{8.42} \\ &= 13.7\% \end{aligned}$$

---

Ex. 2 Original: In 2008, there were 535 students  
New: In 2009, there were 512 students

$$\begin{aligned} \% \text{ of dec.} &= \frac{\text{amt. of change}}{\text{orig. amt.}} \\ &= \frac{535 - 512}{535} = \frac{23}{535} = 4.3\% \end{aligned}$$

# Sales Tax and Discount

Goat: \$120.30

Tax Rate: 7%

---

Method #1

$$\text{Sales Tax} = (.07)(120.30) \\ = \$8.42$$

$$\text{Cost} = 120.30 + 8.42 \\ = \$128.72$$

---

Method #2

$$\text{Cost} = (1.07)(120.30) \\ = \$128.72$$

---

Goat: \$120.30

Discount: 40%

---

Method #1

$$\text{Discount} = (.40) \cdot (120.30) \\ = \$48.12$$

$$\text{Cost} = 120.30 - 48.12 \\ = \$72.18$$

---

Method #2

$$\text{Cost} = (.60)(120.30) \\ = \$72.18$$

100%

- 40%

60%

# Simple Interest

$$\text{Formula: } I = PRT \leftarrow \text{Time (years)}$$

Interest Earned      Principal      Rate as a decimal #

---

$$\text{Ex. 1 } P = \$1,000, R = 3.2\%, T = 5 \text{ years}$$

$$I = PRT$$

$$I = (\$1,000)(.032)(5)$$

$$I = \$160$$

---

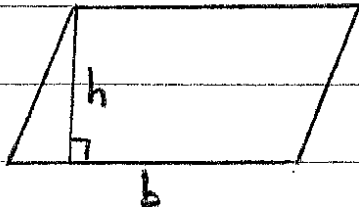
$$\text{Ex. 2 } P = \$1,500, R = 2.75\%, T = 37 \text{ months}$$

$$I = PRT$$

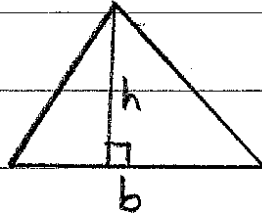
$$I = (\$1,500)(.0275)\left(\frac{37}{12}\right)$$

$$I = \$127.19$$

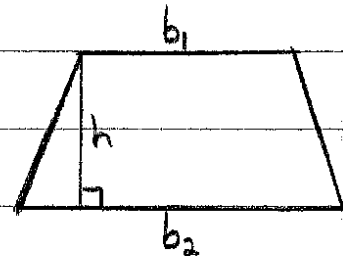
# Area of a Parallelogram, Triangle, and Trapezoid



$$A = bh$$

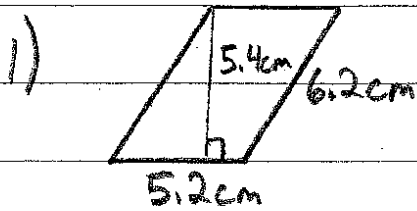


$$A = \frac{1}{2}bh$$



$$A = \frac{1}{2}h(b_1 + b_2)$$

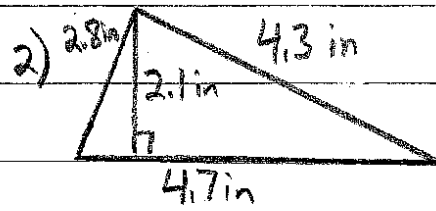
Find the area. Round to the nearest tenth if necessary.



$$A = bh$$

$$A = (5.2)(5.4)$$

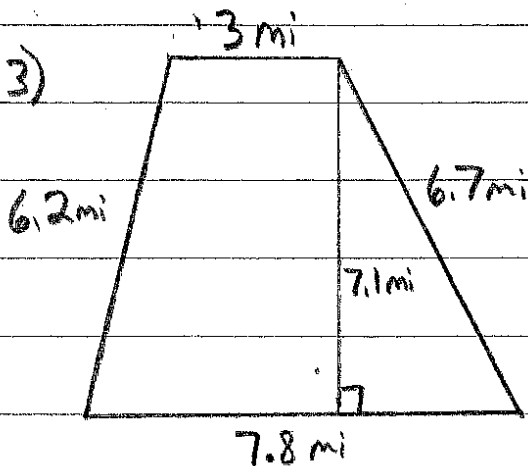
$$A = 28.1 \text{ cm}^2$$



$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2}(4.7)(2.1)$$

$$A = 4.9 \text{ in}^2$$



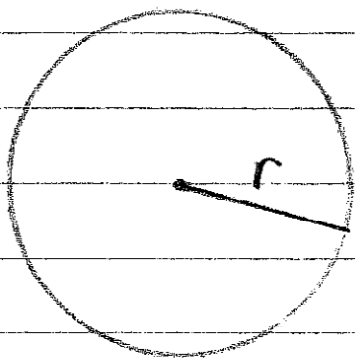
$$A = \frac{1}{2}h(b_1 + b_2)$$

$$A = \frac{1}{2}(7.1)(3 + 7.8)$$

$$A = \frac{1}{2}(7.1)(10.8)$$

$$A = 38.3 \text{ mi}^2$$

# Area and Circumference of a Circle



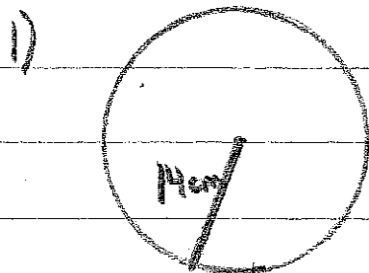
$r = \text{radius}$ ,  $d = \text{diameter}$

$$A = \pi r^2$$

$$C = 2\pi r \text{ or } C = \pi d$$

$$\pi = 3.14 \text{ or } \pi = \frac{22}{7}$$

Find the area and circumference. Round to the nearest tenth if necessary.



$$A = \pi r^2$$

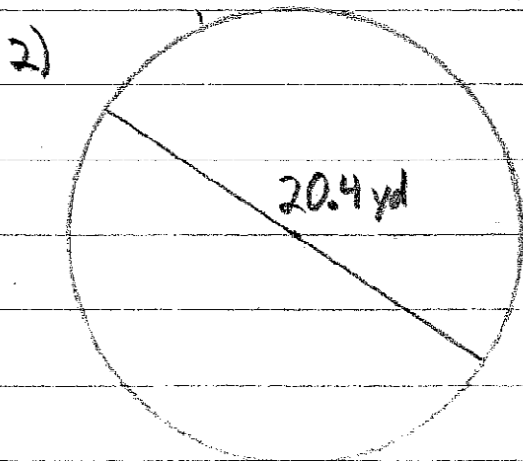
$$A = (3.14)(14^2)$$

$$A = 615.4 \text{ cm}^2$$

$$C = 2\pi r$$

$$C = \frac{2 \cdot 22}{7} \cdot \frac{14}{1}$$

$$C = 88 \text{ cm}$$



$$A = \pi r^2$$

$$A = (3.14)(10.2^2)$$

$$A = 326.7 \text{ yd}^2$$

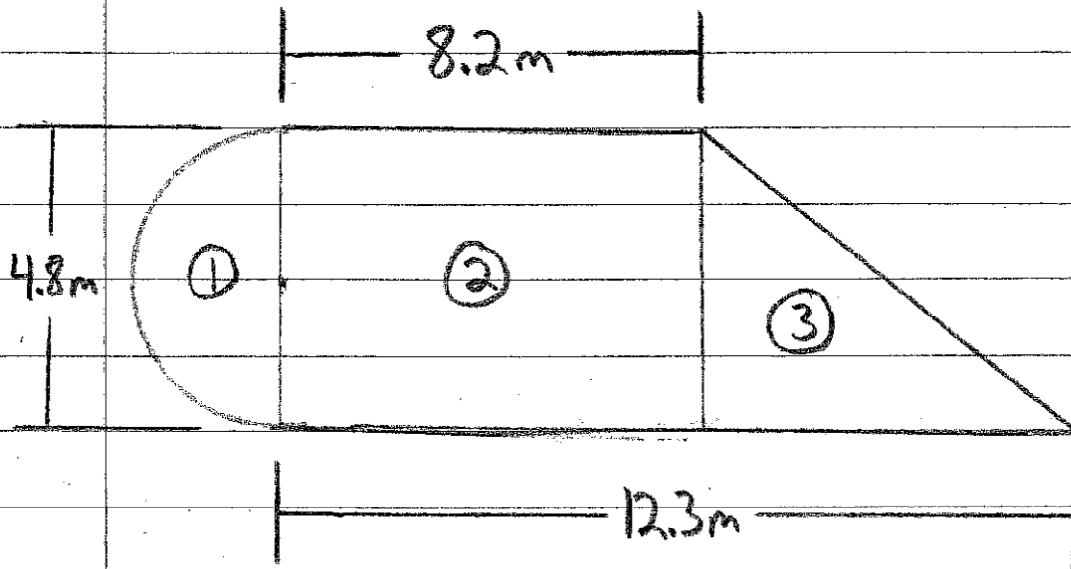
$$C = \pi d$$

$$C = (3.14)(20.4)$$

$$C = 64.1 \text{ yd}$$

# Area of a Complex Figure

Find the area. Round to the nearest tenth.



$$A_1 = \frac{1}{2} \pi r^2$$

$$A_2 = LW$$

$$A_3 = \frac{1}{2} bh$$

$$A_1 = \frac{1}{2} (3.14) (2.4^2)$$

$$A_2 = (4.8)(8.2)$$

$$A_3 = \frac{1}{2} (4.1)(4.8)$$

$$A_1 = 9.0432 \text{ m}^2$$

$$A_2 = 39.36 \text{ m}^2$$

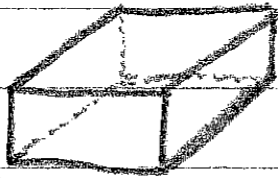
$$A_3 = 9.84$$

$$A_T = A_1 + A_2 + A_3$$

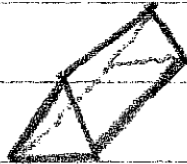
$$A_T = 9.0432 + 39.36 + 9.84$$

$$A_T = 58.2 \text{ m}^2$$

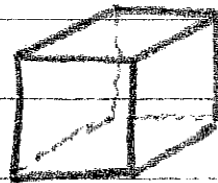
# Three-Dimensional Figures



Rectangular  
Prism



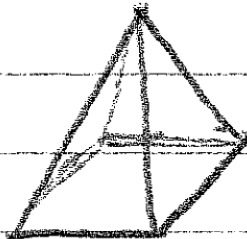
Triangular  
Prism



Cube



Triangular  
Pyramid



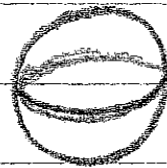
Square  
Pyramid



Cone

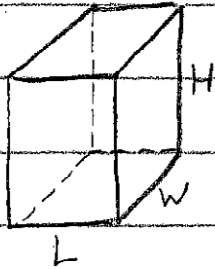


Cylinder

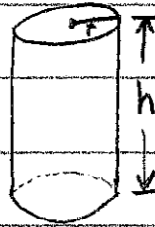


Sphere

# Volume of a Rectangular Prism and Cylinder

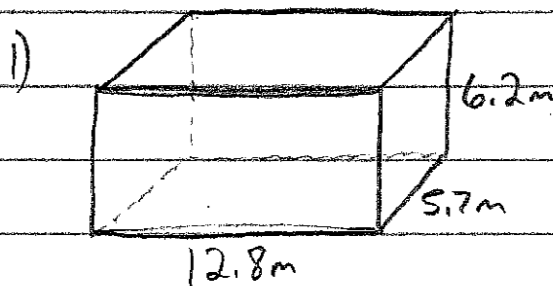


$$V = LWH$$



$$V = \pi r^2 h$$

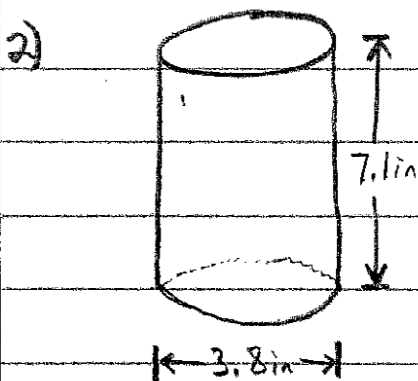
Find the volume. Round to the nearest tenth.



$$V = LWH$$

$$V = (12.8)(5.7)(6.2)$$

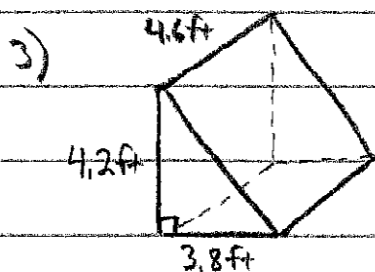
$$V = 452.4 \text{ m}^3$$



$$V = \pi r^2 h$$

$$V = (3.14)(1.9^2)(7.1)$$

$$V = 80.5 \text{ in}^3$$



$$V = \left(\frac{1}{2}bh\right)H$$

$$V = \frac{1}{2}(3.8)(4.2)(4.6)$$

$$V = 36.7 \text{ ft}^3$$

# Estimating Square Roots

$$1 \rightarrow \sqrt{1} = 1$$

$$121 \rightarrow \sqrt{121} = 11$$

$$4 \rightarrow \sqrt{4} = 2$$

$$144 \rightarrow \sqrt{144} = 12$$

$$9 \rightarrow \sqrt{9} = 3$$

$$169 \rightarrow \sqrt{169} = 13$$

$$16 \rightarrow \sqrt{16} = 4$$

$$196 \rightarrow \sqrt{196} = 14$$

$$25 \rightarrow \sqrt{25} = 5$$

$$225 \rightarrow \sqrt{225} = 15$$

$$36 \rightarrow \sqrt{36} = 6$$

$$256 \rightarrow \sqrt{256} = 16$$

$$49 \rightarrow \sqrt{49} = 7$$

$$289 \rightarrow \sqrt{289} = 17$$

$$64 \rightarrow \sqrt{64} = 8$$

$$324 \rightarrow \sqrt{324} = 18$$

$$81 \rightarrow \sqrt{81} = 9$$

$$361 \rightarrow \sqrt{361} = 19$$

$$100 \rightarrow \sqrt{100} = 10$$

$$400 \rightarrow \sqrt{400} = 20$$

1 Estimate the  $\sqrt{75}$ .

$$\sqrt{64} < \sqrt{75} < \sqrt{81}$$

$$8 < \sqrt{75} < 9$$

$$\sqrt{75} \approx 9$$

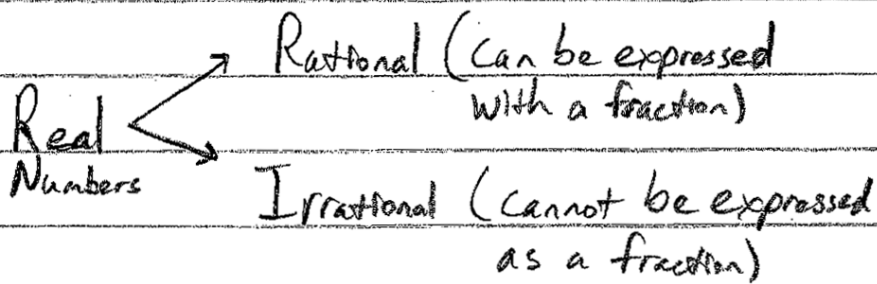
2 Estimate the  $\sqrt{330}$ .

$$\sqrt{324} < \sqrt{330} < \sqrt{361}$$

$$18 < \sqrt{330} < 19$$

$$\sqrt{330} \approx 18$$

# Irrational Numbers



Rational  $\rightarrow 7, \frac{3}{8}, -14.1, -3\frac{2}{3}, 2.\bar{7}$

Irrational  $\rightarrow \pi, \sqrt{2}, -6.8357169\dots$

Compare the numbers.

1)  $\sqrt{20} \circ 4\frac{1}{2}$   
 $4.47 < 4.50$

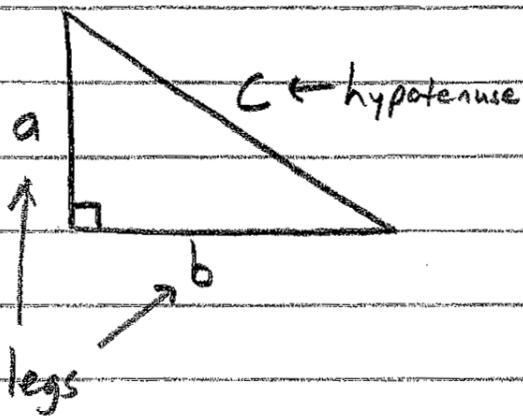
2)  $-2\pi \circ -\sqrt{40}$   
 $-6.28 > -6.32$

Evaluate each expression if  $x = \sqrt{5}$  and  $y = -2.3$ .  
Round to the nearest hundredth.

3)  $2x + 3y$   
 $2(\sqrt{5}) + 3(-2.3)$   
 $4.47 + (-6.9)$   
 $\boxed{-2.43}$

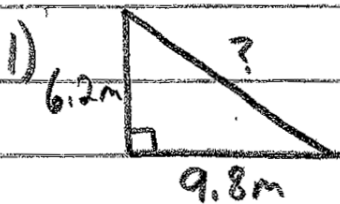
4)  $(\sqrt{11})xy$   
 $(\sqrt{11})(\sqrt{5})(-2.3)$   
 $\boxed{-17.06}$

# The Pythagorean Theorem



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

Find the missing measure of each triangle. Round to the nearest tenth.



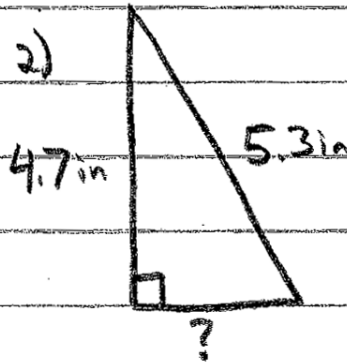
$$c^2 = a^2 + b^2$$

$$c^2 = 6.2^2 + 9.8^2$$

$$c^2 = 38.44 + 96.04$$

$$\sqrt{c^2} = \sqrt{134.48}$$

$$\boxed{c = 11.6\text{m}}$$



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

$$5.3^2 = a^2 + 4.7^2$$

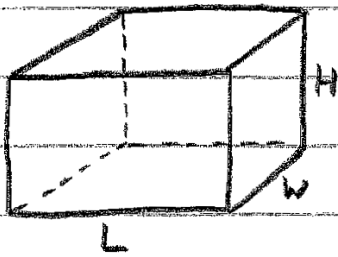
$$28.09 = a^2 + 22.09$$

$$\begin{array}{r} -22.09 \qquad -22.09 \\ \hline \end{array}$$

$$\sqrt{6.00} = \sqrt{a^2}$$

$$\boxed{2.4\text{in} = a}$$

# Surface Area of a Rectangular Prism and Cylinder

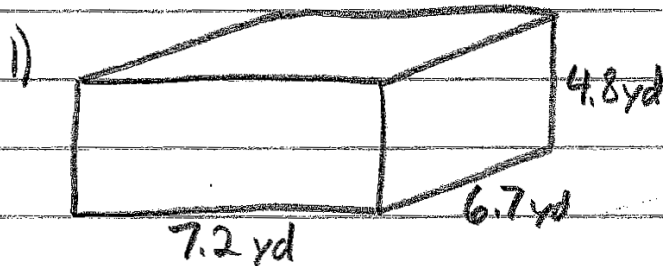


$$SA = 2LW + 2LH + 2WH$$



$$SA = 2\pi r^2 + 2\pi rh$$

Find the surface area. Round to the nearest tenth.

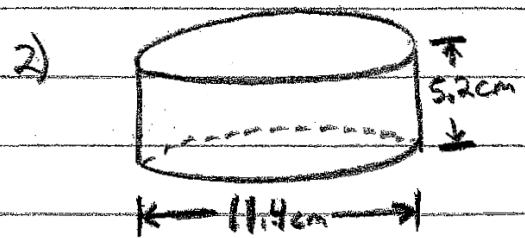


$$SA = 2LW + 2LH + 2WH$$

$$SA = 2(7.2)(6.7) + 2(7.2)(4.8) + 2(6.7)(4.8)$$

$$SA = 96.48 + 69.12 + 64.32$$

$$SA = 229.9 \text{ yd}^2$$



$$SA = 2\pi r^2 + 2\pi rh$$

$$SA = 2(3.14)(5.7^2) + 2(3.14)(5.7)(11.4)$$

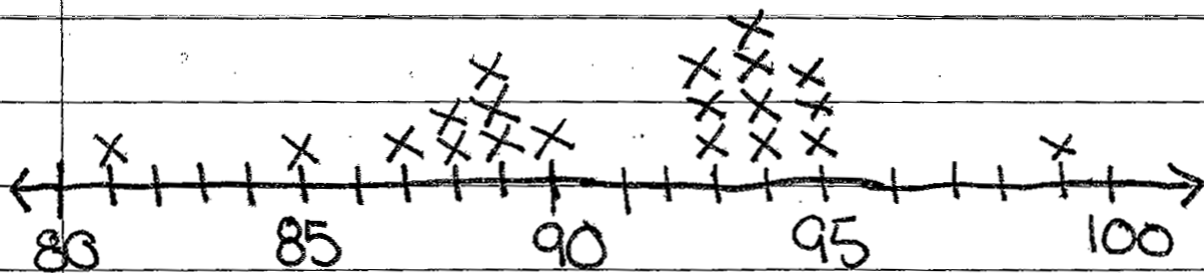
$$SA = 204.0372 + 186.1392$$

$$SA = 390.2 \text{ cm}^2$$

# Line Plot

Test Scores

81	94	88	85	94
93	95	99	95	93
95	94	93	89	89
87	94	88	89	90



Clusters: 87-90, 93-95

Gaps: 82-84, 96-98, 91-92, 86

Outliers: 81, 99

Range:  $99 - 81 = 18$

# Mean, Median, Mode, and Range

Mean  $\rightarrow$  Sum of data divided by number of items

Median  $\rightarrow$  1) Order data set from least to greatest

2) If odd number of data items, it is the middle number

3) If even number of data items, it is the mean of the two middle numbers

Mode  $\rightarrow$  Number that occurs most often

Range  $\rightarrow$  Greatest number minus smallest number

Ex. Find the mean, median, mode, and range.  
(Round to the nearest tenth)

Princeton Tigers

Game	Points
1	65
2	52
3	48
4	65
5	64
6	65

$$\text{Mean} = \frac{65+52+48+65+64+65}{6} = \frac{359}{6} = \boxed{59.8 \text{ Pts. per game}}$$

Median  $\rightarrow$  48, 52, 64, 65, ~~65~~, ~~65~~

$$\frac{64+65}{2} = \frac{129}{2} = \boxed{64.5 \text{ Pts. per game}}$$

$$\text{Mode} = \boxed{65 \text{ Points}}$$

$$\text{Range} = 65 - 48 = \boxed{17 \text{ Points}}$$

# Stem-and-Leaf Plot

Data	Stem	Leaf
22, 60, 54, 12	0	7 8 9
9, 7, 53, 58	1	2 4
14, 28, 61, 8	2	2 8
41, 33, 33, 60	3	3 3
	4	1
	5	3 4 8
	6	0 0 1

$2|8 = 28$  ← Key

Data	Stem	Leaf
3.4 4.7 5.8	3	3 4 4
4.9 6.1 3.3	4	7 7 9
6.4 3.4 4.7	5	8
	6	1 4

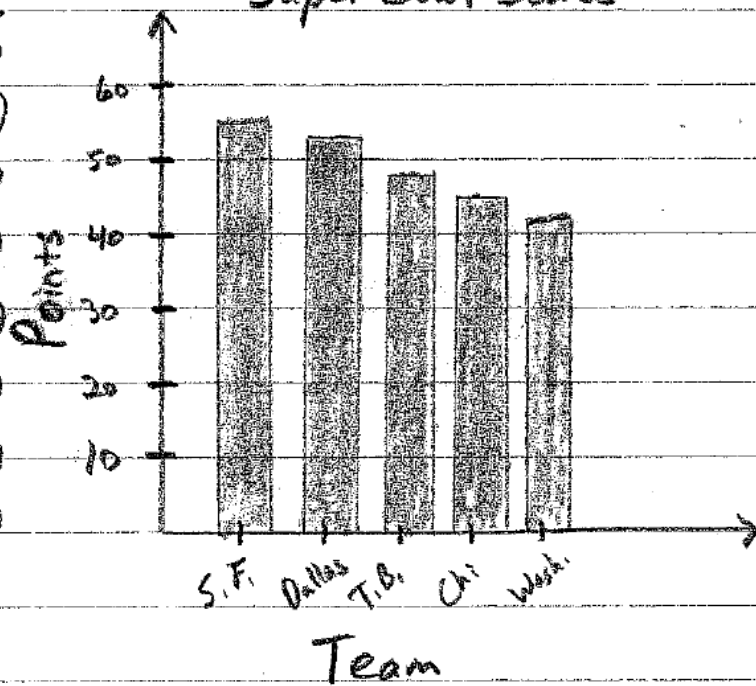
$3|3 = 3.3$  ← Key

# Bar Graph and Histogram

Greatest Number of Points in a Super Bowl

Team	Score
S.F.	55
Dallas	52
Tampa Bay	48
Chicago	46
Wash.	42

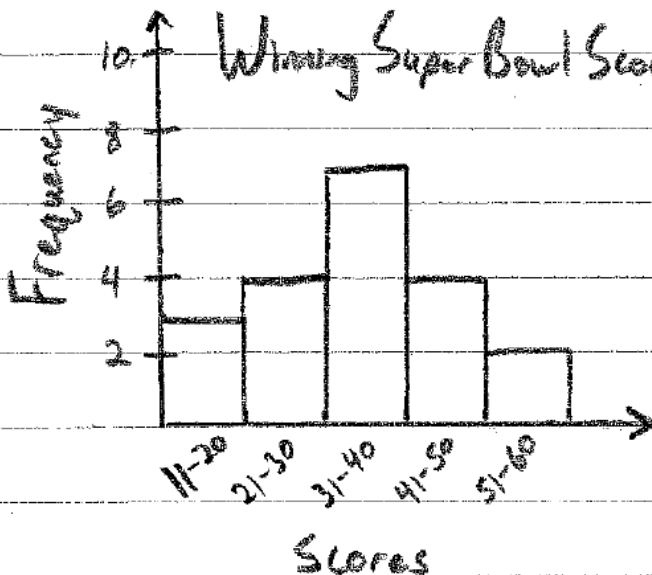
## Super Bowl Scores



Winning Super Bowl Scores

Score	Freq.
11-20	3
21-30	4
31-40	7
41-50	4
51-60	2

## Winning Super Bowl Scores

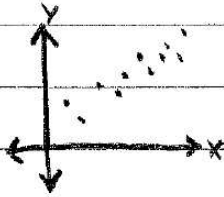


\* Make sure all bar graphs and histograms have 3 labels!

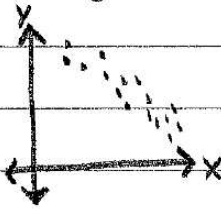
# Using Graphs to Predict

## Types of Relationships

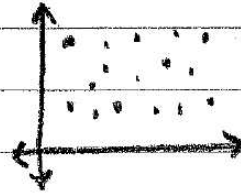
Positive



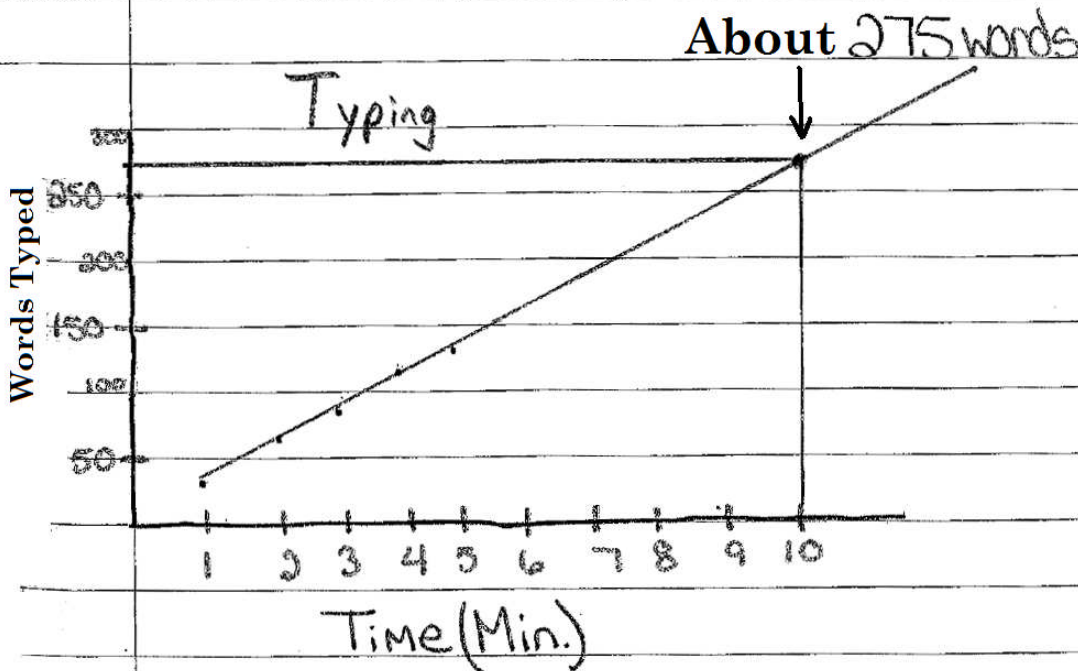
Negative



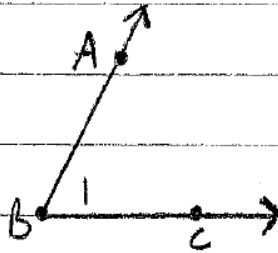
No Relationship



Typing Words	Min.	About how many words can this person type in 10 min.?
28	1	
60	2	
85	3	
110	4	
128	5	

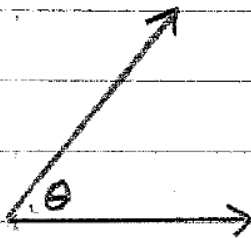


# Angle Relationships



Names:  $\angle ABC$ ,  $\angle CBA$ ,  $\angle B$ ,  $\angle 1$

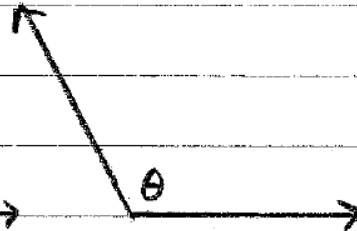
## Types of Angles



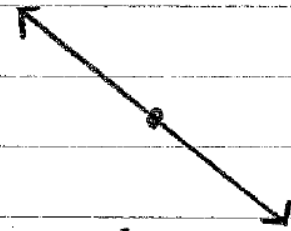
Acute Angle  
 $0^\circ < \theta < 90^\circ$



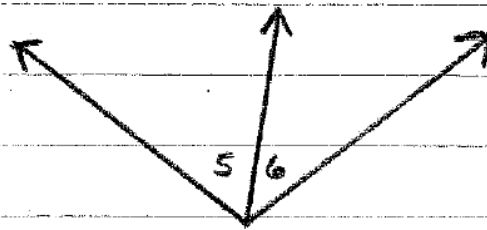
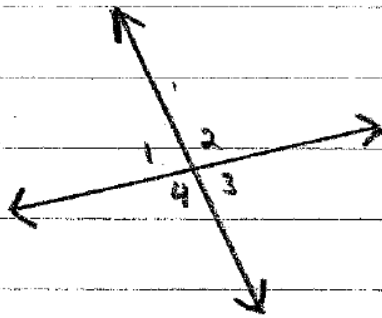
Right Angle  
 $\theta = 90^\circ$



Obtuse Angle  
 $90^\circ < \theta < 180^\circ$



Straight Angle  
 $\theta = 180^\circ$



## Vertical Angles

$$\angle 1 \cong \angle 3$$

$$\angle 2 \cong \angle 4$$

↕ Congruent

## Adjacent Angles (Share a

$$\angle 5, \angle 6$$

side and  
vertex)

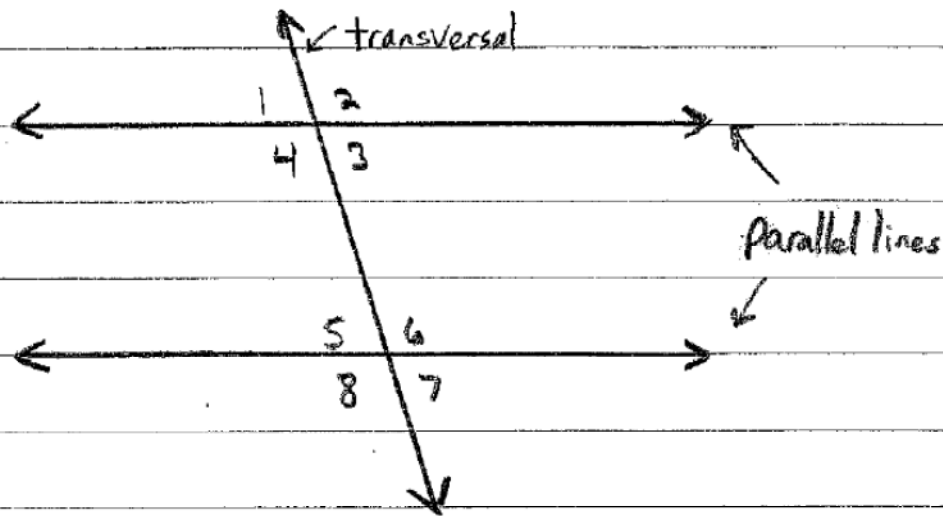
$$\angle 1, \angle 2$$

$$\angle 3, \angle 4$$

$$\angle 2, \angle 3$$

$$\angle 1, \angle 4$$

# Parallel Lines and Transversals



Alternate Interior Angles

$$\angle 3 \cong \angle 5, \angle 4 \cong \angle 6$$

Alternate Exterior Angles

$$\angle 1 \cong \angle 7, \angle 2 \cong \angle 8$$

Corresponding Angles

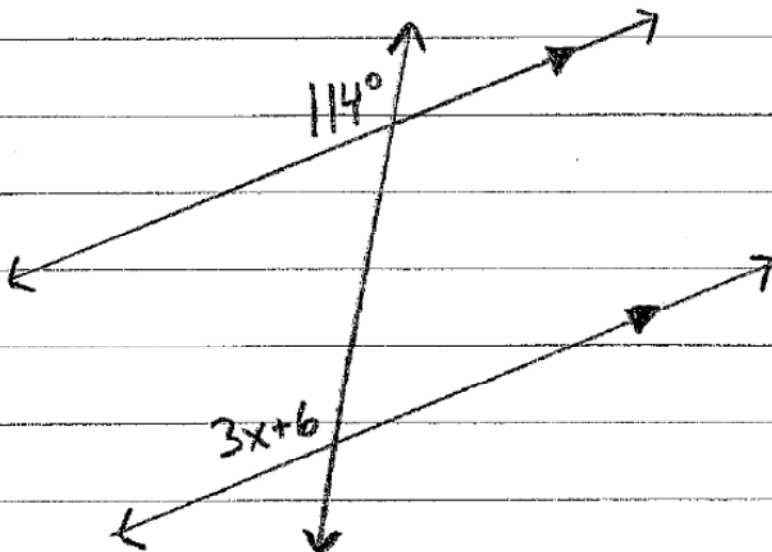
$$\angle 1 \cong \angle 5$$

$$\angle 2 \cong \angle 6$$

$$\angle 3 \cong \angle 7$$

$$\angle 4 \cong \angle 8$$

Find the value of  $x$ .



$$3x+6=114$$

$$\begin{array}{r} -6 \quad -6 \\ \hline \end{array}$$

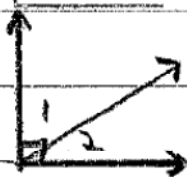
$$3x = 108$$

$$\begin{array}{r} 3 \quad 3 \\ \hline \end{array}$$

$$\boxed{x = 36}$$

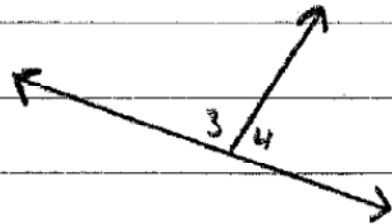
# Complementary and Supplementary Angles

## Complementary



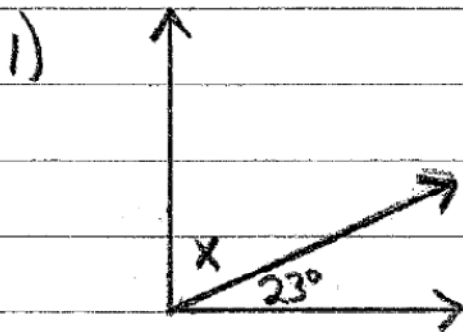
$$m\angle 1 + m\angle 2 = 90^\circ$$

## Supplementary

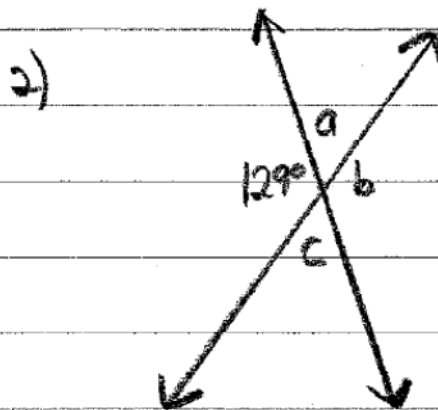


$$m\angle 3 + m\angle 4 = 180^\circ$$

Find the value of the missing angle.



$$\begin{array}{r} x + 23 = 90 \\ -23 \quad -23 \\ \hline \boxed{x = 67^\circ} \end{array}$$



$$\begin{array}{r} a + 129 = 180 \\ -129 \quad -129 \\ \hline \boxed{a = 51^\circ} \end{array}$$

$$c = a$$

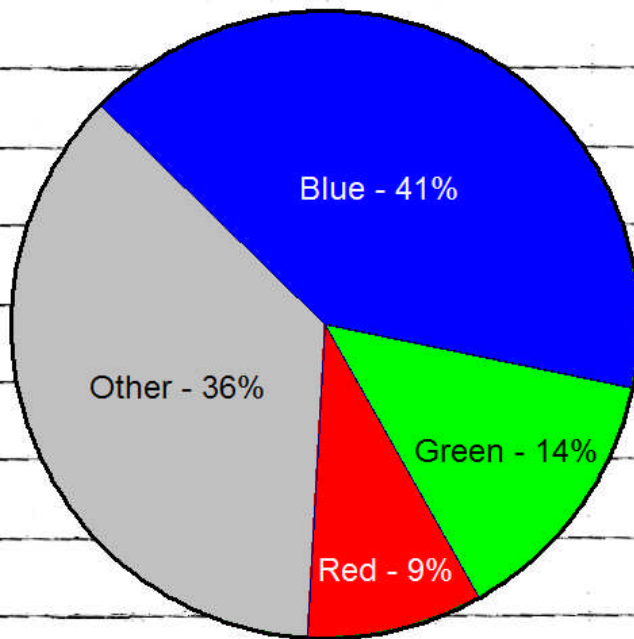
$$\boxed{c = 51^\circ}$$

$$\boxed{b = 129^\circ}$$

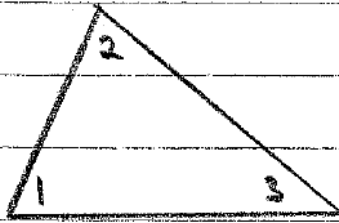
# Circle Graph

Color	# of people	fraction	Percent	Percent X 360°
Green	3	$\frac{3}{22}$	13.6%	49°
Blue	9	$\frac{9}{22}$	40.9%	147°
Red	2	$\frac{2}{22}$	9.1%	33°
Other	8	$\frac{8}{22}$	36.4%	131°

**Favorite Color**

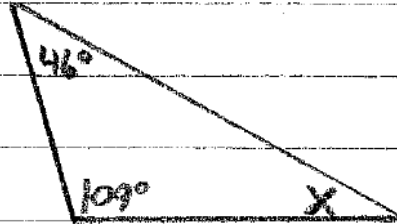


# Triangles

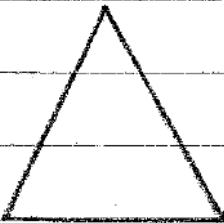


$$m\angle 1 + m\angle 2 + m\angle 3 = 180^\circ$$

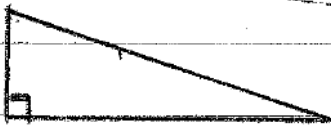
Find the  $m\angle X$ .



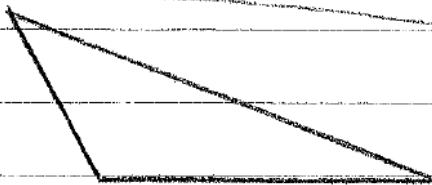
## Classify Triangles (Angles)



Acute Triangle  
3 Acute Angles



Right Triangle  
1 Right Angle  
2 Acute Angles



Obtuse Triangle  
1 Obtuse Angle, 2 Acute Angles

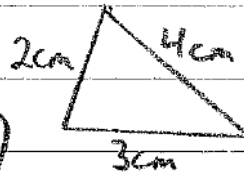
$$X + 46 + 109 = 180$$

$$X + 155 = 180$$

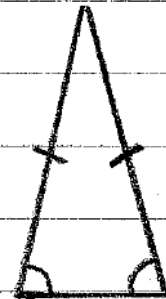
$$-155 \quad -155$$

$$X = 25^\circ$$

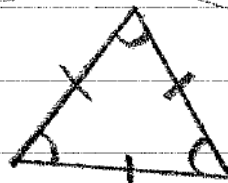
## Classify Triangles (Sides)



Scalene  
No Congruent Sides

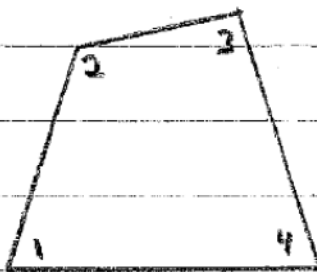
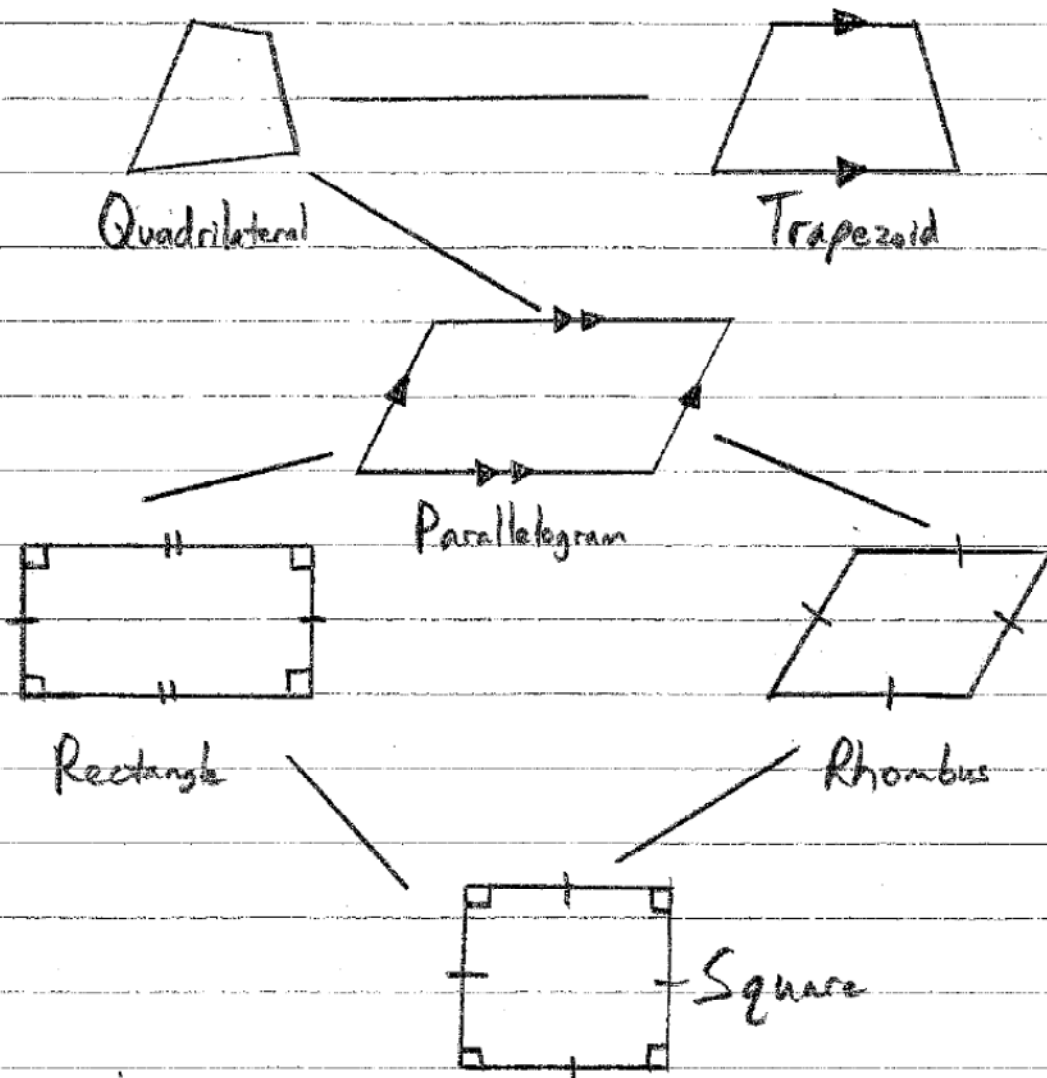


Isosceles Triangle  
2 Congruent Sides and Angles



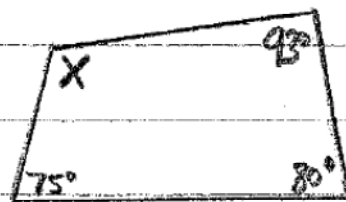
Equilateral Triangle  
All 3 sides and angles are  $\cong$

# Quadrilaterals



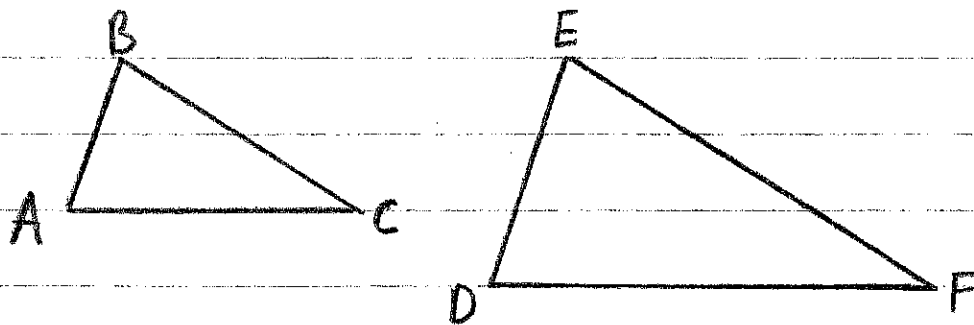
$$m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 = 360^\circ$$

Find the missing angle measure.



$$75 + 80 + 93 = 248$$
$$X = 360 - 248 = 112^\circ$$

# Similar Figures



$$\triangle ABC \sim \triangle DEF$$

↑ "Similar to"

→ Corresponding Sides are Proportional

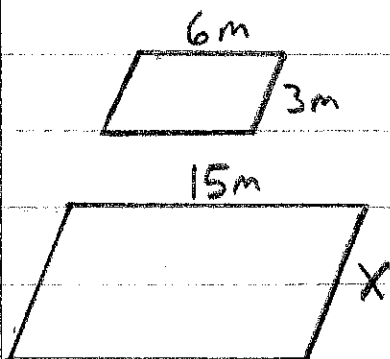
→ Corresponding Angles are Congruent

$$\text{Corresponding Sides: } \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$

$$\text{Corresponding Angles: } \angle A \cong \angle D, \angle B \cong \angle E, \angle C \cong \angle F$$

---

Find the value of  $x$ .



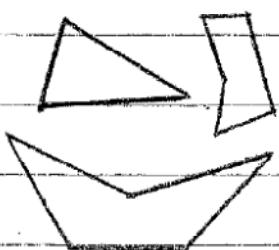
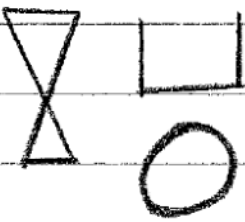
$$\frac{6}{15} = \frac{3}{x}$$

$$\frac{6x}{6} = \frac{45}{6}$$

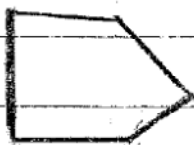
$$x = 7.5 \text{ m}$$

$$\begin{array}{r} 7.5 \\ 6 \overline{) 45.0} \\ \underline{-42} \phantom{0} \\ 30 \\ \underline{-30} \\ 0 \end{array}$$

# Polygons

Polygon	Not a Polygon
	

Pentagon



5 Sides

Hexagon



6 Sides

Octagon



8 Sides

Decagon



10 Sides

Heptagon (7 Sides)

Nonagon (9 Sides)

Regular Polygon  $\rightarrow$  All sides and angles are congruent

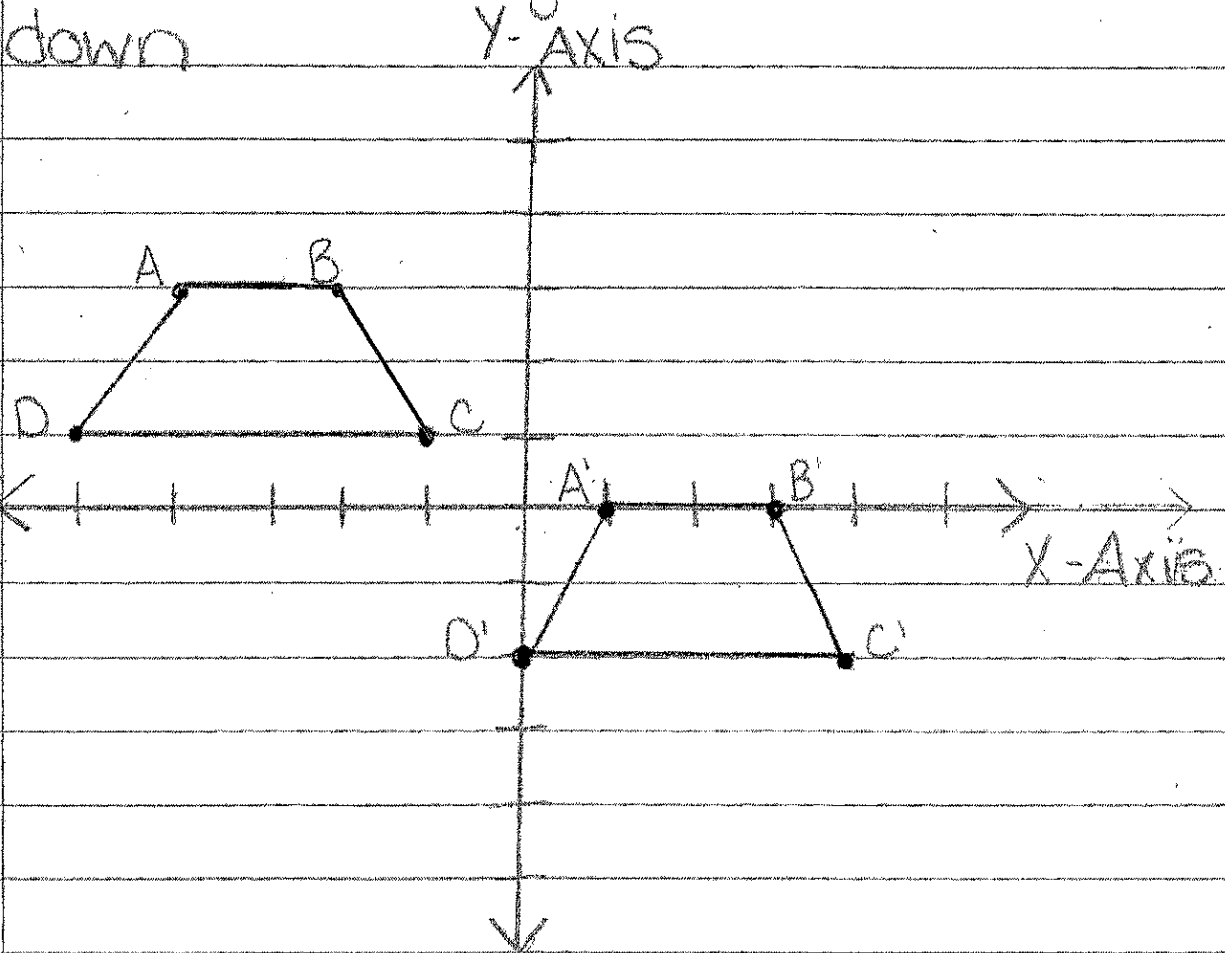
Find the measure of each angle of a regular decagon.

$n = \#$  of sides

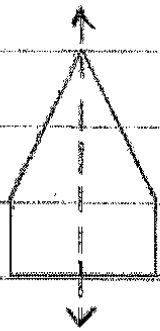
$$\frac{180(n-2)}{n} = \frac{180(10-2)}{10}$$
$$= \frac{180(8)}{10} = \frac{1440}{10} = \boxed{144^\circ}$$

# Translations

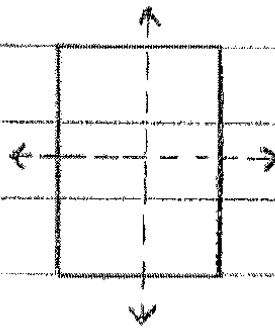
Translate Trapezoid ABCD 5 units to the right and 3 units down



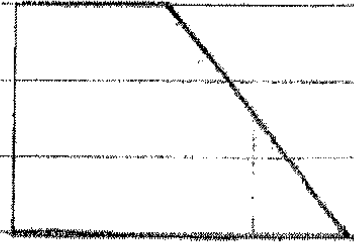
# Reflections



1 Line of Symmetry

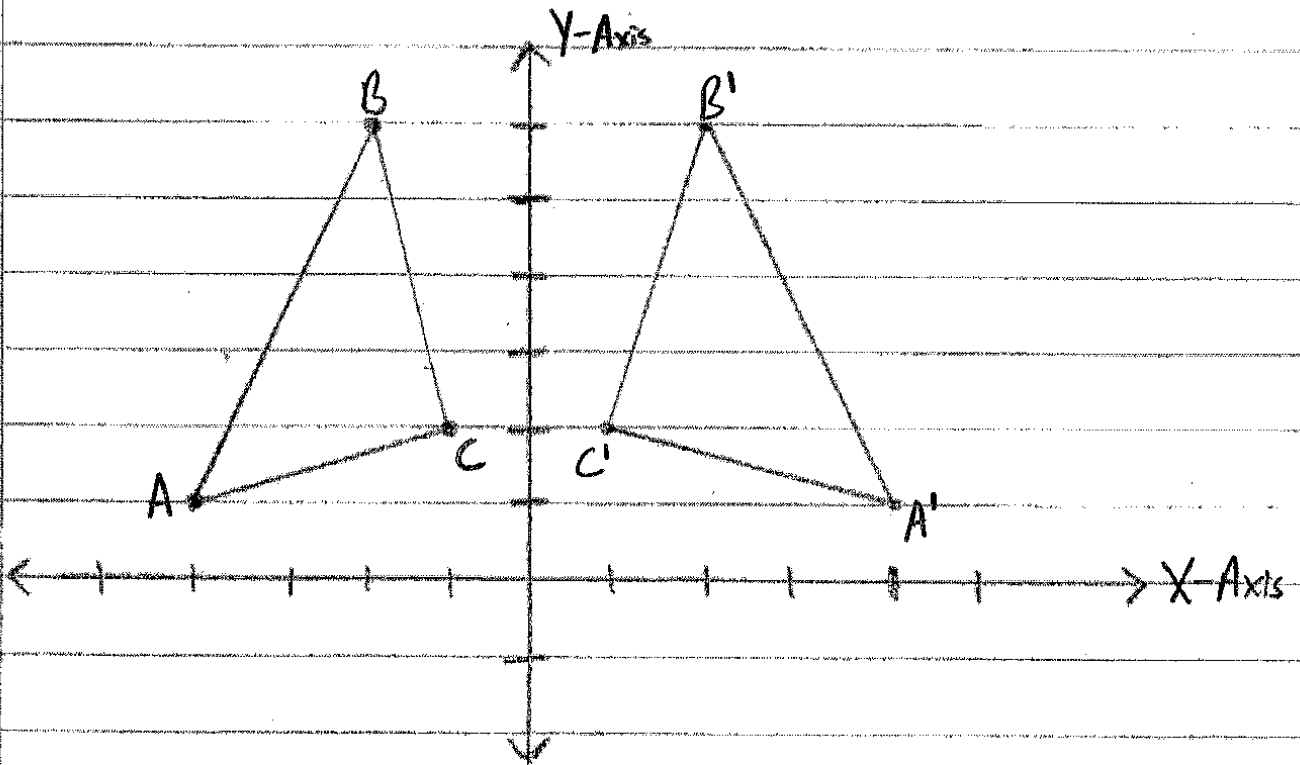


2 Lines of Symmetry



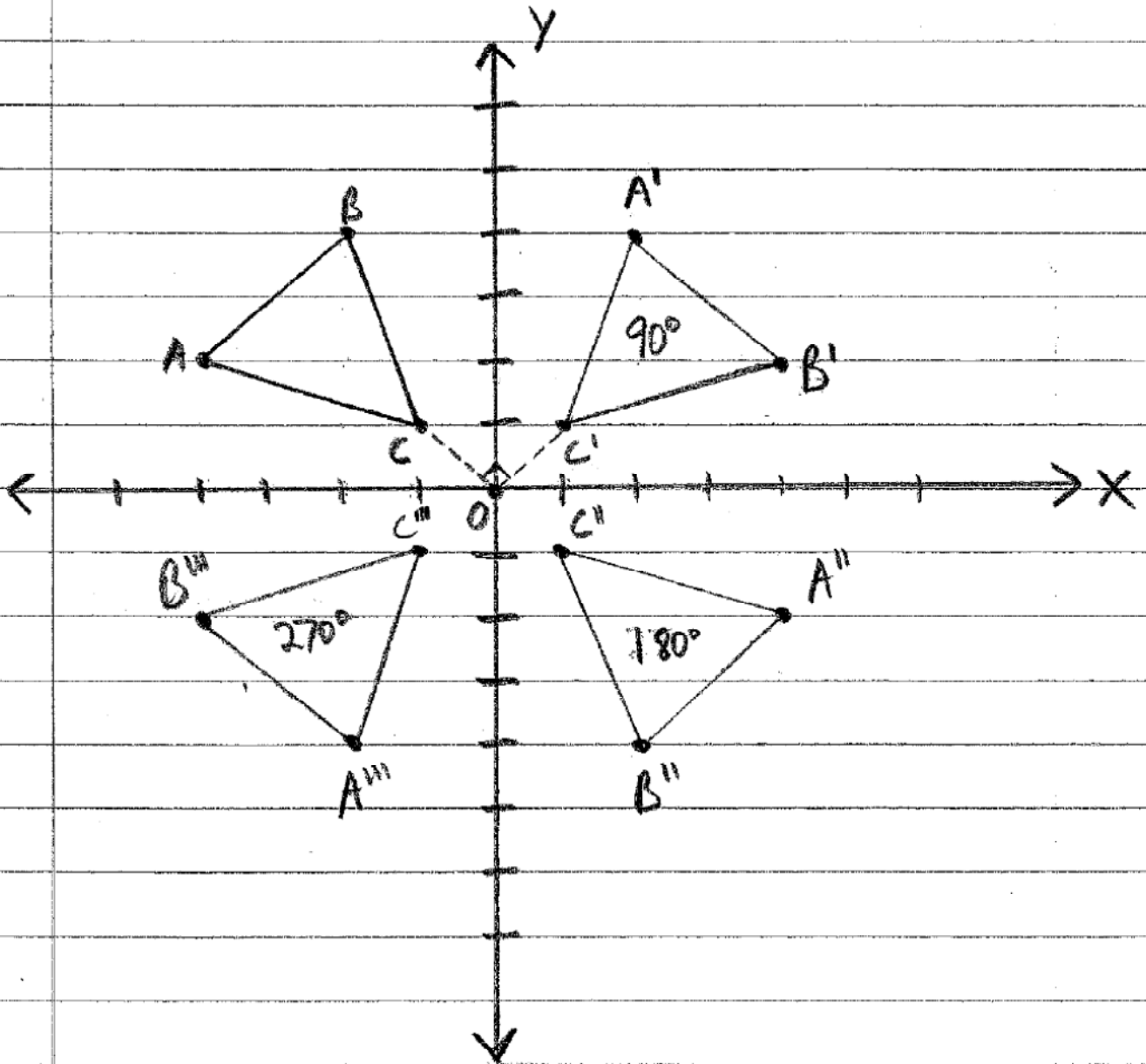
No Line of Symmetry

Reflect the triangle about the Y-Axis.



# Rotations

Rotate  $\triangle ABC$   $90^\circ$ ,  $180^\circ$ , and  $270^\circ$  around the origin.



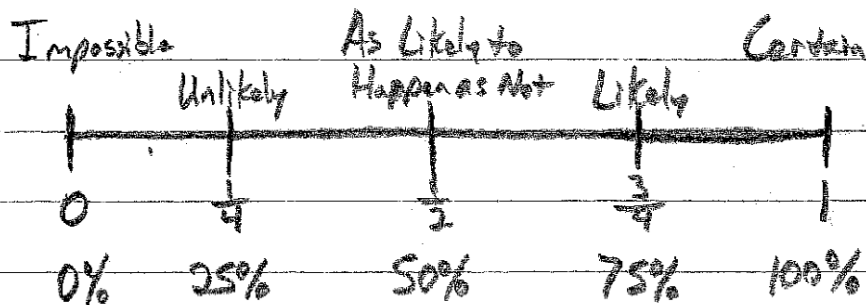
## Simple Events

$$P(\text{Event}) = \frac{\# \text{ of Favorable Outcomes}}{\# \text{ of possible outcomes}}$$

What is the probability of rolling an odd number on a six-sided number cube?

$$P(\text{odd}) = \frac{3}{6} = \boxed{\frac{1}{2}}$$

## Probability of an Event Occurring



Complementary Event  $\rightarrow P(A) + P(\text{not } A) = 100\%$

Using a spinner, what is  $P(\text{red})$  if  $P(\text{not red}) = 82\%$ ?

$$P(\text{red}) = 100\% - 82\% = \boxed{18\%}$$

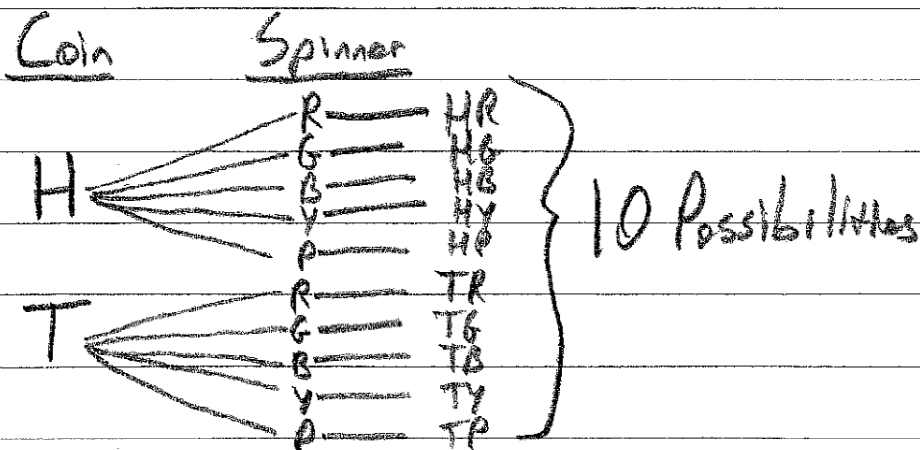
# Sample Spaces

The set of all possible outcomes

- 1) A vendor sells vanilla and chocolate ice cream. Customers can choose from a waffle or sugar cone and either hot fudge or caramel toppings. Find the sample space.

VWF	CWF	} 8 Possible Outcomes
VWC	CWC	
VSF	CSF	
VSC	CSC	

- 2) A game is played by flipping a coin and spinning a spinner with 5 color choices (red, green, blue, yellow, purple). Create a tree diagram to show all possibilities.



# The Fundamental Counting Principle

1) In a game, a coin is flipped, a card is drawn (50 different cards), and a number cube is rolled. How many possible outcomes?

$$2 \times 50 \times 6 = 100 \times 6 = \boxed{600 \text{ Possibilities}}$$

2) In a closet, there are 6 pairs of shoes, 11 different shirts, and 3 pairs of shorts. How many different outfits?

$$6 \times 11 \times 3 = 66 \times 3 = \boxed{198 \text{ Possibilities}}$$

# Permutations

An arrangement of objects in which order is important.

1) How many different arrangements can 9 people sit in 3 chairs?

$$\begin{array}{ccc} 9 & \times & 8 \\ \square & & \square \\ \text{Chair 1} & & \text{Chair 2} \end{array} \times \begin{array}{c} 7 \\ \square \\ \text{Chair 3} \end{array}$$

$$9 \times 8 \times 7 = 72 \times 7 = \boxed{504 \text{ different arrangements}}$$

2) A four-letter password is used to login to a computer. How many possibilities of passwords are there if no letter can be repeated?

$$\underline{26} \times \underline{25} \times \underline{24} \times \underline{23}$$

$$= \boxed{358,800 \text{ different passwords}}$$

# Combinations

An arrangement of objects in which order is not important.

Student Council consists of 4 students. Ten students are running for these positions. How many different student arrangements are possible?

$$\underline{10} \cdot \underline{9} \cdot \underline{8} \cdot \underline{7} \leftarrow \text{Number of Permutations (Entire Set)}$$

$$\underline{4} \cdot \underline{3} \cdot \underline{2} \cdot \underline{1} \leftarrow \text{Number of Permutations (Smaller Set)}$$

$$10 \cdot 9 \cdot 8 \cdot 7 = 5,040$$

$$4 \cdot 3 \cdot 2 \cdot 1 = 24$$

$$\text{Combinations: } \frac{5,040}{24} = \boxed{210 \text{ Possibilities}}$$

# Theoretical and Experimental Probability

What is the probability of rolling two dice and getting a sum of 7?

## Theoretical

$$\begin{array}{ccc} 6 & \times & 6 \\ \text{Possibilities} & & \text{Possibilities} \\ \uparrow & & \uparrow \\ \text{Roll \#1} & & \text{Roll \#2} \end{array} = 36 \text{ Possibilities}$$

Favorable Outcomes  $\rightarrow$  1,6 / 2,5 / 3,4 / 4,3 / 5,2 / 6,1

$$P(7) = \frac{6}{36} = \boxed{\frac{1}{6}}$$

## Experimental

- ✓ Two dice rolled 100 times
- ✓ Sum of the dice is written down
- ✓ The sum of 7 is rolled 19 times

$$P = \boxed{\frac{19}{100}}$$