IGCSE Geometry Summer Assignment 2019

Name: _____

Congratulations, again, on your acceptance into The Cambridge Programme at Brentsville District High School! I commend you for your commitment to your education and your desire to accept the challenge of IGCSE Geometry. You strive for success and the educators at BDHS aim to support you and your goals. This assignment is designed to address objectives from the Prince William County middle school mathematics curricula. Mastery of these objectives is critical to students' success in IGCSE Geometry. There are also Geometry objectives at the end of the packet. These questions are on material that you will see frequently this year in IGCSE Geometry. It is important that students complete this assignment individually. Please bring this assignment on the first day of school. The completed assignment will be collected during the second week of school.

Assignment Checklist:

- ✓ Use a pencil
- ✓ Write your name on your paper
- ✓ Neatly show all necessary work for each problem
- ✓ Complete the entire assignment
- ✓ Bring the assignment to Brentsville on your first day of school
- ✓ Bring the following materials to school on the first day of class:
  - ❖ 3-ring binder to help keep you organized (2 inch is recommended)
  - ❖ Notebook paper
  - ❖ Pencils
  - ❖ Colored Pencils (optional, but highly recommended)
  - ❖ Highlighters (optional, but highly recommended)
  - ❖ Calculator

****All freshmen are recommended to purchase a graphing calculator. The Casio *fx*-9750GII is the calculator used most often in class; however, a TI is acceptable as well. ****

Pre-Algebra and Algebra I Review:

Steps for Solving Equations

1. Get rid of any fractions and/or decimals
2. If possible, combine like terms on one or both sides of the equal sign
3. Use the distributive property when necessary
4. Move the variables to one side of the equal sign
5. Move the constants to other side of the equal sign
6. Isolate the variable

Solving Equations with Special Solutions

Example #1: Solve the following equation.

$10 - 8a = 10 - 4a - 4a$
$10 - 8a = 10 - 8a$ Combine like terms.
$+ 8a \quad + 8a$ Add $8a$ to each side of the equation.
$10 = 10$
INFINITELY MANY SOLUTIONS!

Because 10 always equals 10, this is called an **identity**. Whenever this happens when you solve an equation, you write "Infinitely Many Solutions."

Example #2: Solve the following equation.

$6m - 5 = 7m + 7 - m$
$6m - 5 = 6m + 7$ Combine like terms
$-6m \quad -6m$ Subtract $6m$ from each side of the equation.
$-5 = 7$
NO SOLUTION!

Because -5 never equals 7, there is **no solution** to this equation. Whenever this happens when you solve an equation, you write "No Solution."

Practice:

1. $-3(2t - 1) = 15$
2. $9 + 5x = 7x + 9 - 2x$
3. $n - (3n + 4) = -6$

4. $8 - v + 4 = 2v - 12 + v$
5. $10 + 3x + 29 = -(x - 23)$
6. $9 + 5n = 5n - 1$

7. The length of a rectangle is 6 inches more than its width. The perimeter of the rectangle is 24 inches. What is the length of the rectangle?

Need Help?
Perimeter means add all the sides

8. The width of a rectangle is 2 cm less than its length. The perimeter of the rectangle is 16 cm. What is the length of the rectangle?

Solving Inequalities

When you _____ or _____ by a _____, you _____ the inequality symbol!!

1. $-11 \geq 6 - 2n - 5$
2. $30 - 6a < -3(5 + 7a)$
3. $-33 - h \leq -3(2h + 1)$
4. $8(1 + 8x) + 8(x - 11) < -10x + 2x$

Solving Proportions

1. To solve a proportion, we _____ _____.

Solve the following proportions.

2. $\frac{4}{9} = \frac{x-3}{6}$

3. $\frac{5}{r-9} = \frac{8}{r+5}$

4. $\frac{P+10}{p-7} = \frac{8}{9}$

5. $\frac{3}{2x} = \frac{3x}{8}$

6. $\frac{x-4}{2} = \frac{x}{x-4}$

7. $\frac{3x-1}{8} = \frac{x}{3x-1}$

Slope

Remember:

- When points on a graph make a line, a ratio like $\frac{units\ up}{units\ right}$ can be written as $\frac{change\ in\ y-value}{change\ in\ x-value}$ or $\frac{change\ in\ dependent\ variable}{change\ in\ independnet\ value}$. This is called a **rate of change**.
- Rate of change is also called the **slope** of a line. The **rate of change (slope)** is the change in *y*-value divided by the change in *x*-value.
- We can find **slope** by looking at a graph and seeing how far we have to go up or down and how far we have to go over (left or right) to get from point to point.
- Slope Formula: $m = \frac{y_2-y_1}{x_2-x_1}$

1. Using the slope formula, find the slope of the line passing through the given points.

   a. (0, 0) and (3, 5)

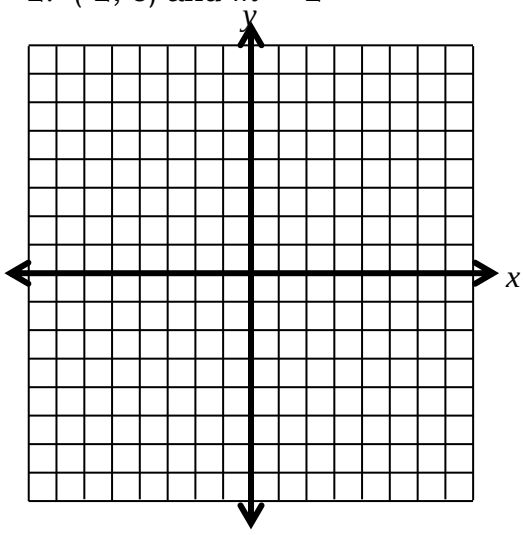
   b. (5, -2) and (-7, 4)

   c. (-6, 3) and (-2, -9)

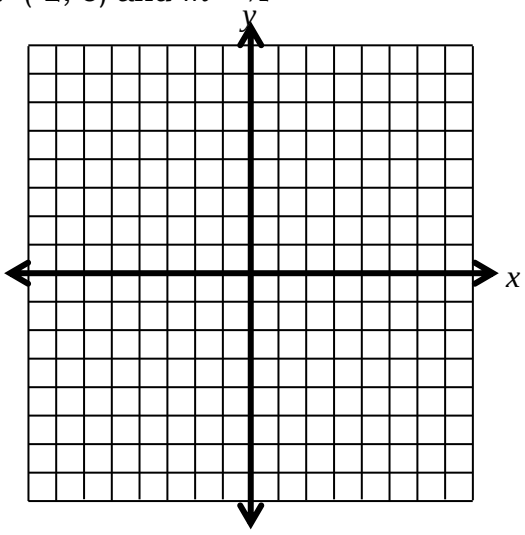
   d. (6, -9) and (-4, 3)

Draw a line containing the given point and given slope.

2. (-2, 5) and m = -2

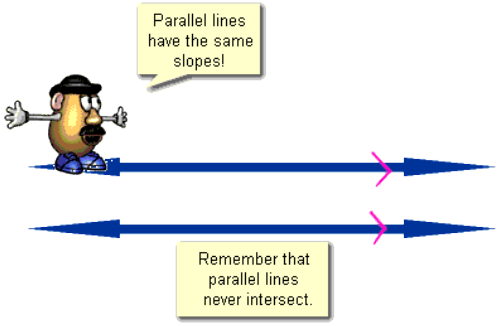


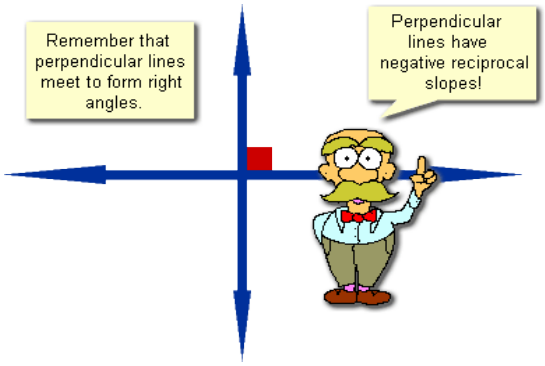
3. (-2, 5) and m = ½



Parallel and Perpendicular Lines

Remember:





1. Is it possible for two lines with negative slopes to be perpendicular? Explain your reasoning.

2. Is it possible for two lines with positive slopes to be parallel? Explain your reasoning.

3. Circle all the given equations that are parallel lines.
   Box all the given equations that are perpendicular lines.
   You must show your work by converting each equation to slope-intercept form ($y = mx + b$).

$x + 2y = 3$ $\qquad$ $3x + y = 10$ $\qquad$ $-6x + 2y = 10$

$y = -3x - 9$ $\qquad$ $y = \frac{1}{2}x - 8$ $\qquad$ $6y = 12x + 24$

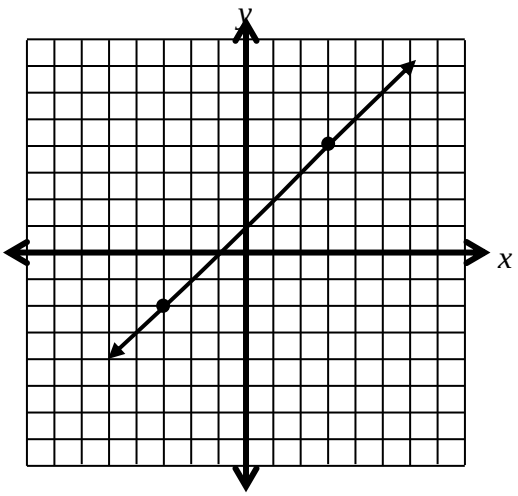
Slope Intercept Form

REMEMBER:

Slope-Intercept Form

$y = mx + b$

Example: Write the equation of the line in the graph given.



Step 1: Find the slope of the line.

Two points on the line are: (-3, -2) and (3, 4)

Slope = $\frac{y_2-y_1}{x_2-x_1} = \frac{4--2}{3--3} = \frac{4+2}{3+3} = \frac{6}{6} = 1$

Step 2: Find the *y*-intercept.

Remember the y-intercept is where the line crosses the y-axis!

The *y*-intercept is 1.

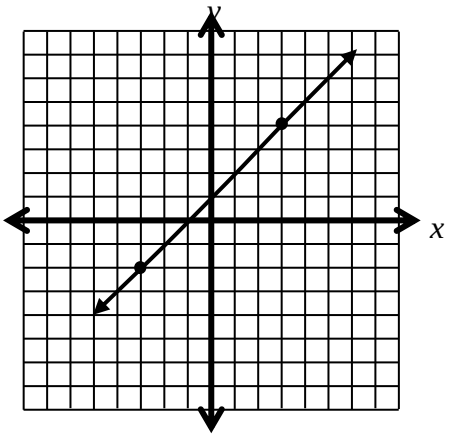
Step 3: Put the slope and the *y*-intercept into the equation $y = mx + b$.

$y = x + 1$

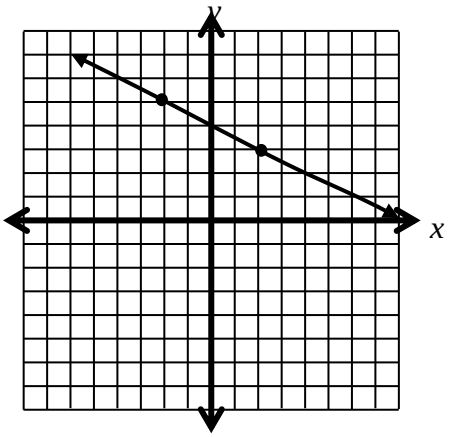
Practice:

1. Write the equation of the line in the graph given.

a. Equation: _____

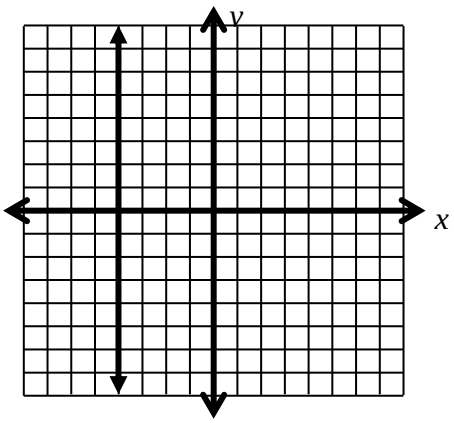


b. Equation: _____

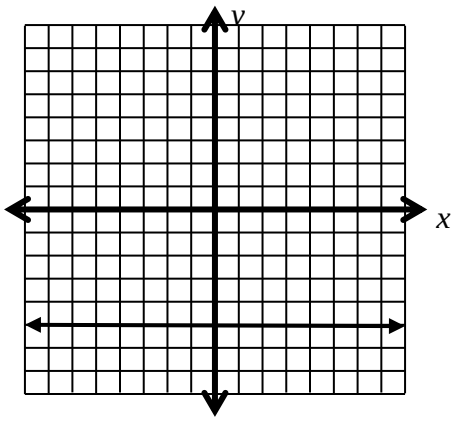


2. Write the equation of the line in the graph given.

a. Equation: _____



b. Equation: _____

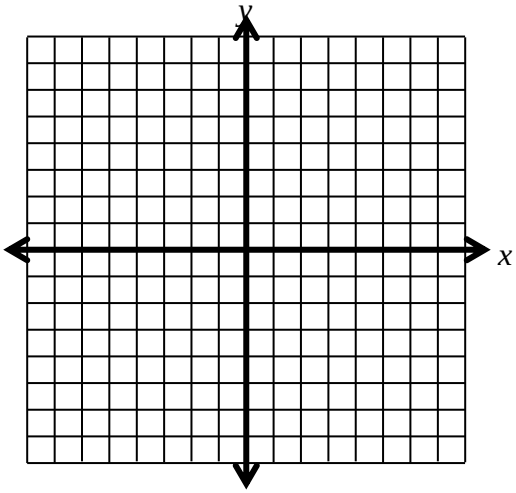


3. Write the equation of a line that passes through the points (-2, 1) and (4, 6).

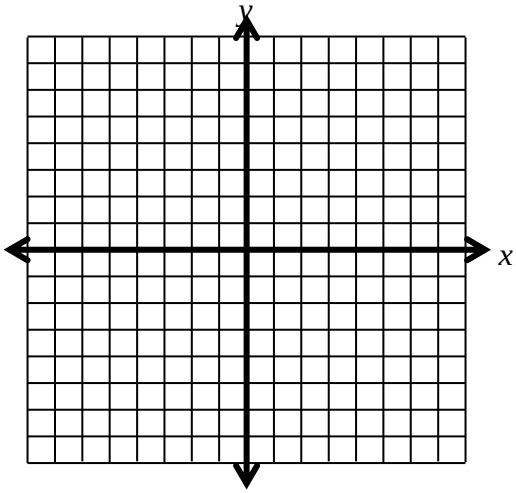
4. Write the equation of a line that passes through the points (0, 0) and (2, 5).

5. Graph the following lines.

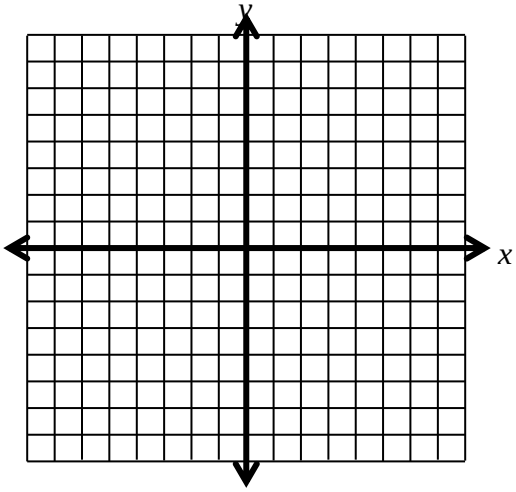
a. $y = 2x - 4$



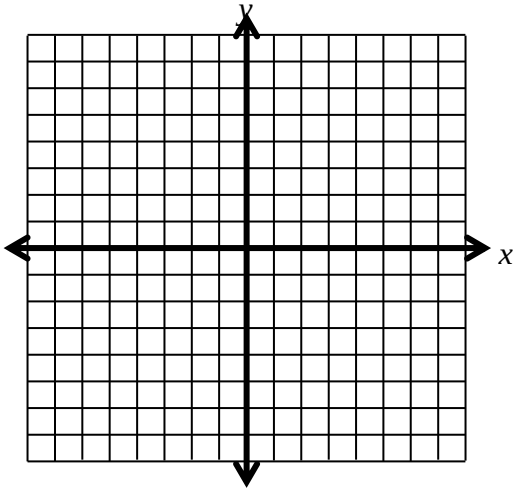
b. $y = -\frac{2}{3}x$



c. $x = 6$

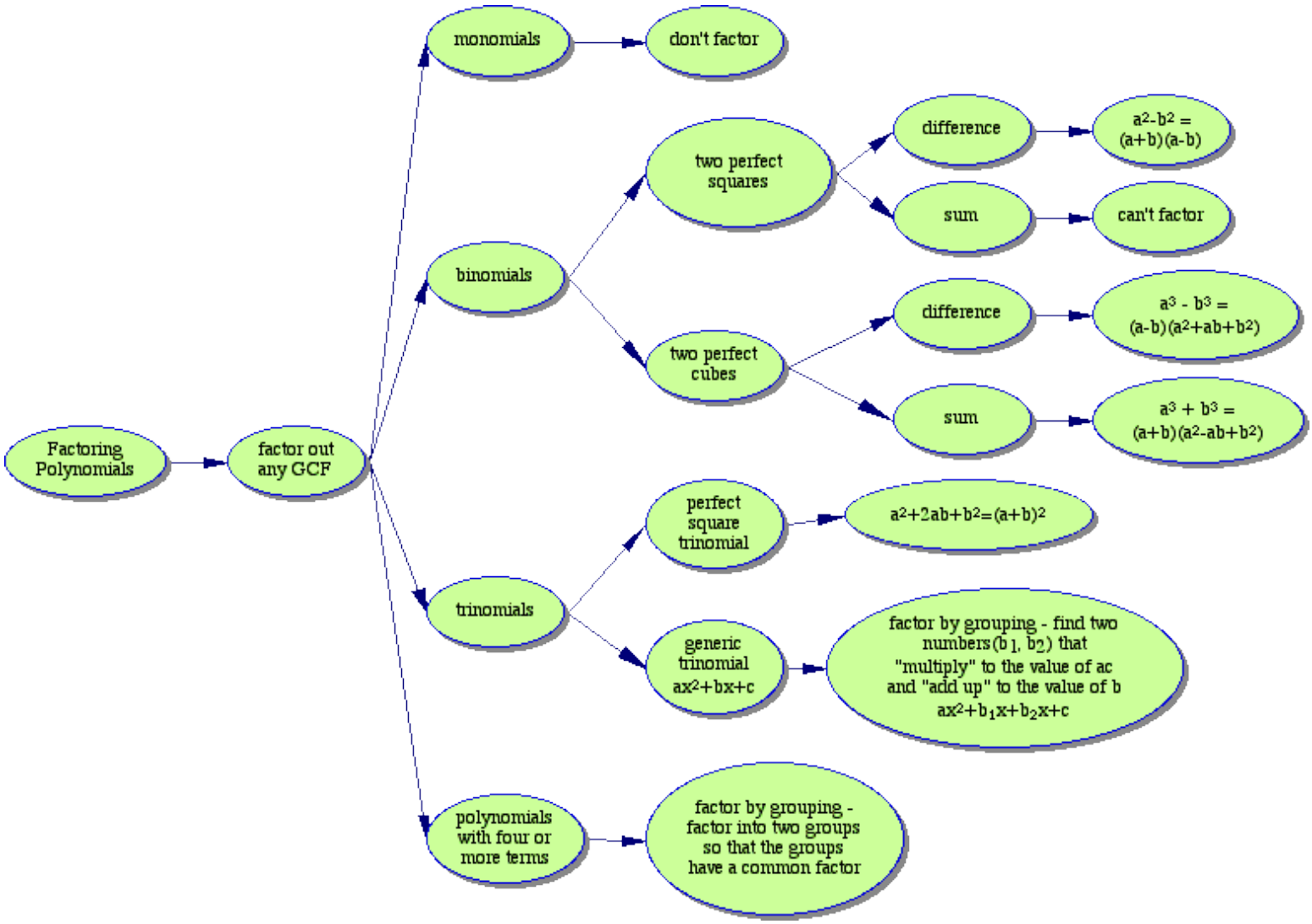


d. $y = -2$



Factoring

It is very important you remember and understand how to factor before school starts.



1. **State the GCF**: $6x^3$ and $36x^5$

2. **State the GCF**: $5a^3b$ and $35a$

3. **Factor**: $8x^2 - 32x$

4. **Factor**: $12x^3y^4 - 42x^2y + 30xy^2$

5. Factor: $x^2 - 6x - 7$

6. Factor: $x^2 + 14x - 49$

7. Factor: $x^2 - 7x + 12$

8. Factor: $x^2 + 49$

9. Factor: $2x^2+11x+12$

10. Factor: $4x^2-36$

11. Factor: $2x^2-7x-15$

12. Factor: $3x^2-27$

13. Factor: $4x^2-12x+9$

14. Factor: $3x^2+2x-5$

Solving Quadratics by Facotring

Zero-Product Property

For every real number a and b, if $ab = 0$, then $a = 0$ or $b = 0$.

Example: If $(x + 3)(x + 2) = 0$, then $x + 3 = 0$ or $x + 2 = 0$.

Example #1: Solve $(x – 3)(x – 4) = 0$

The Zero Product Property tells me that at least one of the factors must be equal to zero. Since at least one of the factors must be zero, I'll set them *each* equal to zero:

$x – 3 = 0$ or $x – 4 = 0$

This gives me simple linear equations, and they're easy to solve:

$x = 3$ or $x = 4$

For #15 – 20, solve each quadratic by factoring and then apply the zero-product property.

15. $v^2 – 11v – 60 = 0$

16. $m^2 + 13m – 36 = 0$

17. $2t^2 – 4t – 70 = 0$

18. $2y^2 + 15y + 7 = 0$ 19. $a^3x - 9ax^3 = 0$ 20. $20 - 60x + 45x^2 = 0$

Geometry Prep:

We will use the distance and midpoint formula several times throughout the school year. It is essential that you memorize these formulas before school starts.

The Distance Formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Practice:

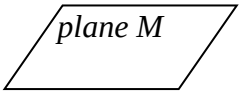
1. Find the distance between *E*(-5, 6) and *F*(8, -4).
2. Find the distance between *M*(-3, 2) and *N*(5, -3).

The Midpoint Formula

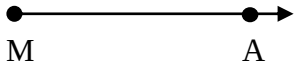
$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

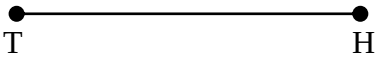
3. Find the coordinates of the midpoint of $\overline{JL}$ if *J* has coordinates of (-1, 2) and *L* has coordinates of (3, -5).
4. *M* is the midpoint of $\overline{AB}$. Given *A*(-4, 2) and *B*(3, 6), find the coordinates of *M*.

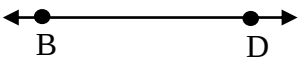
Vocabulary and Angles

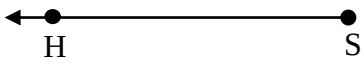
Vocabulary Word	**Definition**	**Picture**	**Geometric Notation**
Point	A point is the basic unit of geometry. It has no size. It is infinitely small. A point is smaller than the smallest dot you can make with your pencil.		P
Line	A line is a straight arrangement of points. There are infinitely many points on a line. It has length but no thickness. A line continues on forever in both directions.		$\overleftrightarrow{AB}$
Plane	A plane has length and width but no thickness. It is a flat surface that extends forever. A wall, a floor, or a ceiling is a model of a plane.		M or Plane M
Segment	A line segment is made up of two points and all of the points between them. It is a piece of a line. The two points at either end of the segment are called endpoints. A line segment is named using two points and a symbol that looks like a line segment.		$\overline{AB}$
Ray	A ray begins at a point and goes on forever in one direction. It has one endpoint. A ray is named using two points and a symbol that looks like a ray. The point corresponding to the endpoint must be written first and the symbol must always be pointing right.		$\overrightarrow{RS}$

Name the following lines, segments, or rays using proper notation.

1. 

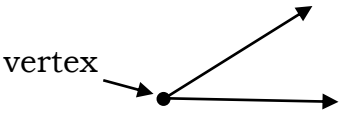
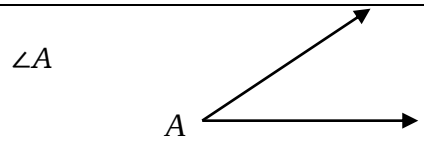
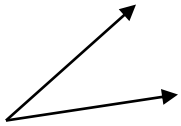
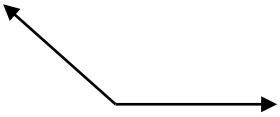
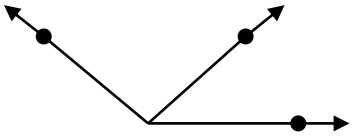
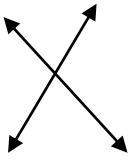
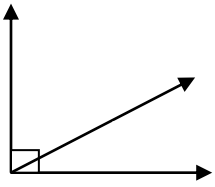
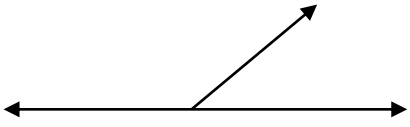
2. 

3. 

4. 

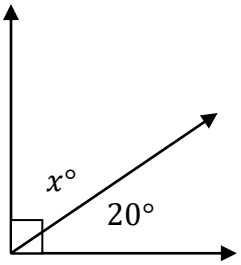
5. Sketch and label a picture of the following:

a. $\overleftrightarrow{GH}$ b. Plane R c. $\overline{MN}$

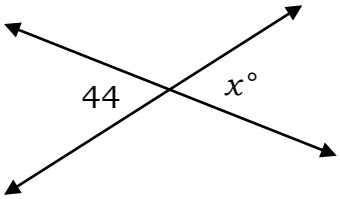
Vocabulary Word	Definition	Picture
Vertex	A vertex is the point where the endpoints of two rays meet to form an angle.	
Angle	An angle is two rays that share a common endpoint.	
Acute Angle	An acute angle is an angle whose degree measure is less than 90°	
Obtuse Angle	An obtuse angle is an angle whose degree measure is greater than 90°	
Right Angle	A right angle is an angle whose degree measure is exactly 90°	
Adjacent Angles	Adjacent angles are angles that are next to each other.	
Vertical Angles	Vertical angles are angles that are across from each other.	
Complementary Angles	Complementary angles add up to 90°.	
Supplementary Angles	Supplementary angles add up to 180°	

6. Solve for x.

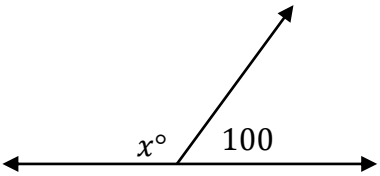
a.

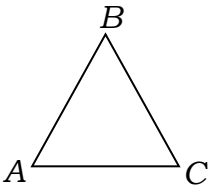
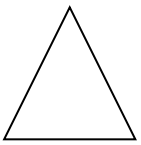
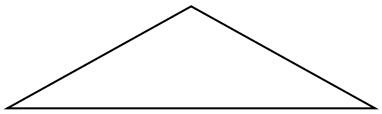
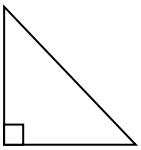
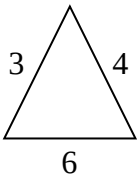
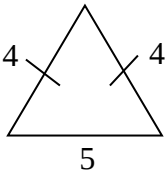
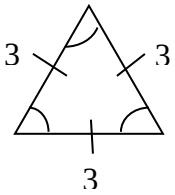


b.



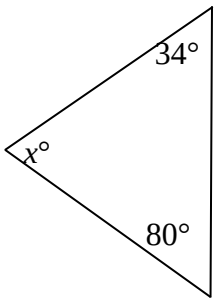
c.



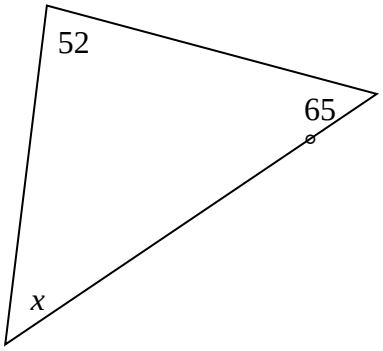
Vocabulary Word	Definition	Picture
Triangle	A triangle is a three sided figure. The angles inside a triangle all add up to 180°. In order for a triangle to exist the two smallest legs added together have to be greater than the third leg.	ΔABC 
Acute Triangle	An acute triangle is a triangle that has all acute angles.	
Obtuse Triangle	An obtuse triangle is a triangle that has an obtuse angle.	
Right Triangle	A right triangle is a triangle that has a right angle. The right angle is shown on the triangle using a small square.	
Scalene Triangle	A scalene triangle is a triangle that has no sides the same length.	
Isosceles Triangle	An isosceles triangle is a triangle that has two sides (called legs) that are the same length. The third side is called the base. The two equal legs are marked using lines that show they are equal.	
Equilateral Triangle	An equilateral triangle is a triangle that has all sides equal and all the angles inside the triangle are 60°. The equal sides are marked with a line to show that they are equal. The angles are marked with arcs that show they are all equal.	

7. Solve for x.

a.



b.



8. Using each answer once, match each of the triangles with their classification.

right _____

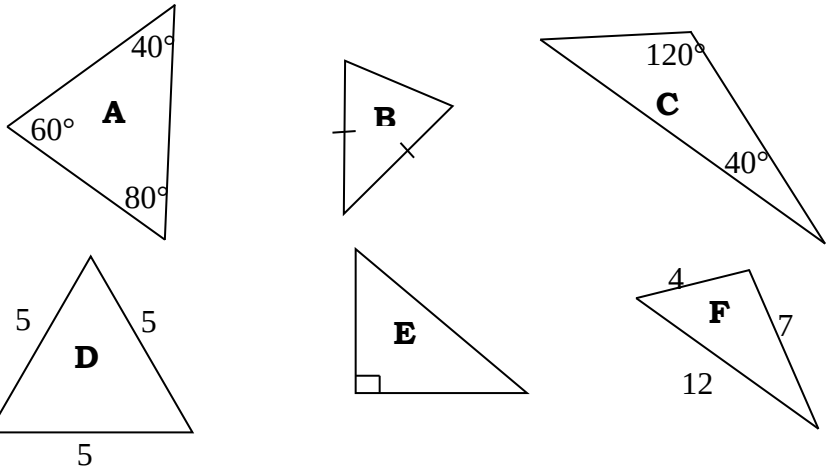
scalene _____

obtuse _____

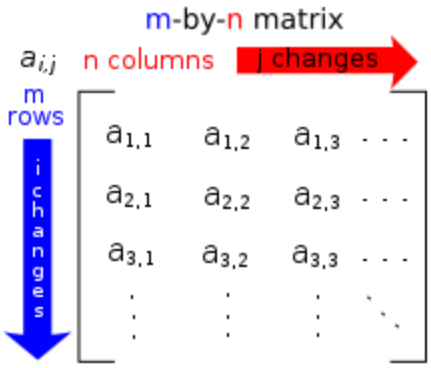
equilateral _____

isosceles _____

acute _____



Intro to Matrices



1. Use Matrix C below to answer the following questions.

$$C = \begin{bmatrix} 2 & 4 & 6 & 9 \\ 1 & 0 & 8 & 5 \\ -3 & 7 & 12 & 3 \end{bmatrix}$$

C has how many rows? _____

C has how many columns? _____

State the dimensions of C (Row x Column). _____

What entry is in the 3, 2 position (also written as C_{32}). _____

How many elements are in Matrix C? _____

Note: In Cambridge, we use ( ) instead of [ ] for matrices.

Adding and Subtracting Matrices

$$\begin{bmatrix} a_1 & a_2 \\ a_3 & a_4 \end{bmatrix} + \begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix} = \begin{bmatrix} a_1 + b_1 & a_2 + b_2 \\ a_3 + b_3 & a_4 + b_4 \end{bmatrix}$$

In order to add or subtract matrices, they must have the SAME dimensions

2. $\begin{pmatrix} 9 & 5 & 8 & -2 \\ 1 & 3 & -6 & -9 \end{pmatrix} + \begin{pmatrix} -3 & 5 & 4 & 1 \\ -6 & -1 & 0 & 4 \end{pmatrix} =$

3. $\begin{pmatrix} 8 & 4 \\ 3 & 1 \end{pmatrix} - \begin{pmatrix} 3 & 5 \\ 1 & 6 \end{pmatrix} =$

4. $\begin{pmatrix} \frac{1}{2} & \frac{2}{3} \\ \frac{3}{2} & \frac{1}{6} \end{pmatrix} - \begin{pmatrix} \frac{1}{5} & \frac{1}{6} \\ \frac{1}{4} & \frac{2}{3} \end{pmatrix} =$

5. $\begin{pmatrix} 100 & 521 \\ 426 & 987 \end{pmatrix} - \begin{pmatrix} 158 \\ 634 \end{pmatrix}$

Scalar Multiplication

Example: $3 \cdot \begin{bmatrix} 1 & 5 \\ -2 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 15 \\ -6 & 12 \end{bmatrix}$

6. $5\begin{pmatrix} 3 & -5 \\ -7 & 8 \\ 6 & 0 \end{pmatrix}$

7. $-\frac{1}{2}\begin{pmatrix} 8 & -3 \\ -6 & 7 \end{pmatrix}$

Matrix Multiplication

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \times \begin{bmatrix} j & k & l \\ m & n & o \\ p & q & r \end{bmatrix} =$$

$$\begin{bmatrix} aj + bm + cp & ak + bn + cq & al + bo + cr \\ dj + em + fp & dk + en + fq & dl + eo + fr \\ gj + hm + ip & gk + hn + iq & gl + ho + ir \end{bmatrix}$$

8. $\begin{pmatrix} -2 & 5 \\ 2 & 0 \end{pmatrix} \times \begin{pmatrix} -6 & 1 \\ 4 & 8 \end{pmatrix}$

9. $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 2 & 3 \\ 5 & 9 \end{pmatrix}$

10. $\begin{pmatrix} 1 & 2 & 3 \\ 4 & -5 & 6 \end{pmatrix}\begin{pmatrix} 7 & -8 & 9 \\ 10 & 11 & 12 \\ 0 & 14 & 15 \end{pmatrix}$

Now that you have completed this assignment, you should use this knowledge throughout the school year in IGCSE Geometry. Remember to be on time for class; have the necessary materials with you; be willing to give your best effort; complete all assignments independently, correctly and completely; turn in all assignments on time; be prepared for all assessments; and ask questions when you are confused. You are ready for the challenge and success that await you next school year! ☺