Name: _____

Analytic Geometry Workbook

We are learning to find:

a. Perpendicular Bisector, Midsegment, Median and the altitude of a triangle.
b. Midpoint and Length of a line segment
c. The Equation of a Circle
d. Classifying Geometric Figures

Equation of a Line

Write the equation of the line that passes through the given point and slope.

Slope = - 1/2, y-intercept = 4

Slope = 5/2, y-intercept = 1

Write the equation of the line that passes through the given points and slope.

(-2, -2), slope = -1

(1, -2), slope = -7

(5, -2), slope = -2/5

(-4, -3), slope = 2/3

Write the equation of the line that passes through the given points:

(-3, -4) and (0, 1)

(0, -4) and (5, -3)

(4, 3) and (1, 0)

(-2, 3) and (-5, 3)

Write the equation of the line that passes through the given point and slope.

(5, 1), parallel to y = -1/5x – 1

(-1, 5), parallel to y = -x + 1

(-5, -1), perpendicular to y = -5/4x - 5

(3, -2), perpendicular to y =3/4x - 3

Midpoint and Distance Formulas

Find the midpoint of the line segment with the given endpoints.

1) (6, 5), (-2, 2)

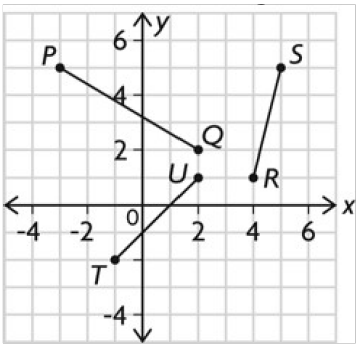
2) (-5, -3), (-1, 6)

Given the midpoint and one end point, find the other end point

3) Endpoint (6,-3) midpoint (2,6)

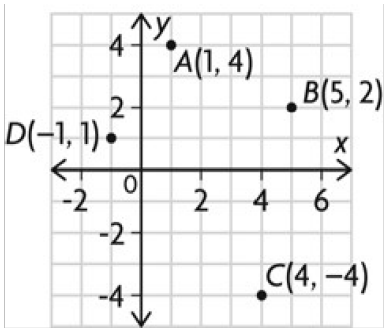
4) Endpoint (-17,-7) midpoint (13, -20)

Determine the coordinates of the midpoint of each line segment.



M_{PQ} = $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ M_{rs} = M_{TU} =

Calculate the distance between

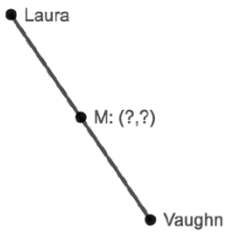


d_{AB} = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ d_{BD} =

d_{CD} = d_{AC} =

Application Problems - Mid Point and Distance

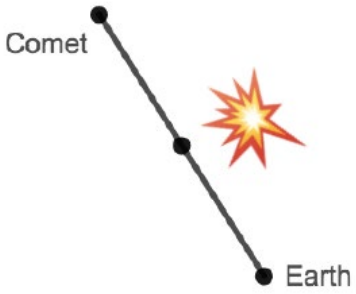
Laura and Vaughn stand at opposite corners of a gym and run to meet each other at exactly the same speed. Where do they meet?



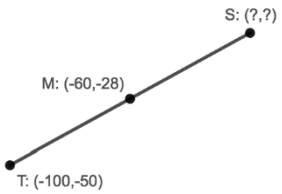
Laura: (-19 , 32)

Vaughn: (17 , -21)

Earth mounts a defense against a comet hurtling towards it. We fire a missile that travels at the same speed as the comet. It hits and destroys it, saving the world!!! Earth was at (2.5 , -6.2) and the explosion happened at (-2 , 0.95). What was the location of the comet when the missile was fired?



Line segment ST has an endpoint T: (-100 , -50) and Midpoint M: (-60 , -28), what are the coordinates of the other endpoint?



Keisha and Sabrina pick a spot to have lunch halfway between their homes. Keisha lives at (-14 , 8) and the restaurant M is at (3.5 , -0.5). What is the location of Sabrina's house?

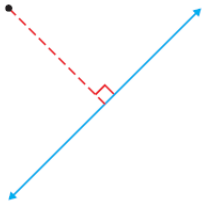
Distance Word Problems

A coordinate system is superimposed on a billiard table. Gord has a yellow ball at A(2, 3). He is going to "bank" it off the side rail at B(6, 5), into the pocket at C(2, 7). How far will the yellow ball travel?

A forest fire is threatening two small towns, Mordon and Bently. On a map, the fire is located at (10, -11), the fire hall in Mordon is located at (26, 77), and the fire hall in Bently is located at (12, -88). Which fire hall is closer to the fire?

The shortest distance between a point and a line is a perpendicular line. Calculate the distance between each line and the point. (Hint you will need a POI)

a) $y = 4x - 2$, point $(-3, 3)$



b) $2x + 3y = 6$, point $(7, 6)$

Perpendicular Bisectors

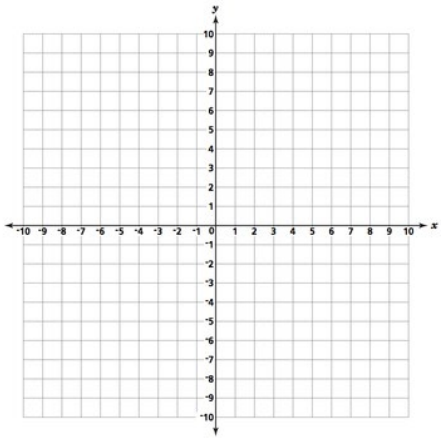
1. Find the equation of the perpendicular bisector of the line joining each pair of points,

(a) A(2, 8) and B(4, 6)

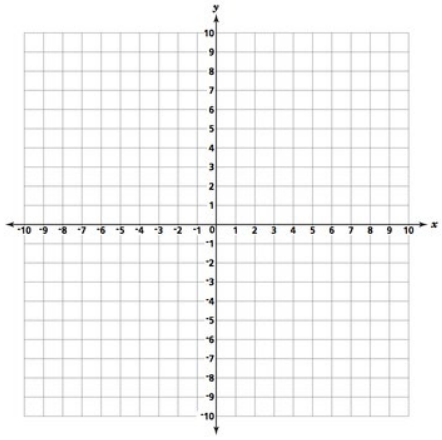
(b) P(9, 5) and Q(-1, 3)

Medians of a triangle

a) Triangle QER has vertices Q(7, 3) E(9, 0) and R(5, 1). Find the equation of the median which passes through Vertex E



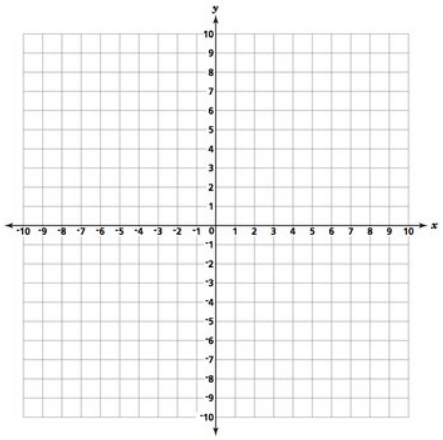
(b) Triangle MFP has vertices M(4, -6) F(2, 8) P(-8, 4). Find the equation of the median which passes through the midpoint of FP.



Altitudes of a triangle

1. In each triangle find the equation of the altitude from B.

(a) P(7, 3) R(-5, -1) B(1, 6)

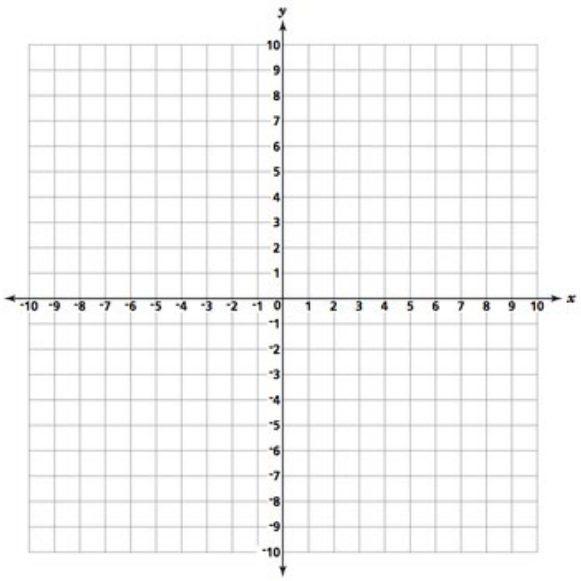


(b) K(4, -7) H(5, -6) B(3, 1)

2. In triangle DEF find the equation of the altitude from D, where D is (4, 5) and EF has equation $y = 3x + 2$

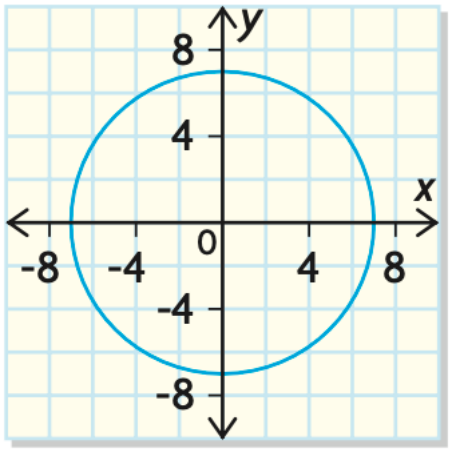
Midsegments

Plot the triangle (7,7), (−3, −5), (5, −3). Draw the midsegment from line PQ to line PR. Calculate the slope of that midsegment, then the slope of line QR. What do you notice?



Circles

1. The graph at the right shows a circle with centre at (0,0).



a) State the x-intercepts.

b) State the y-intercepts.

c) State the radius

d) Write the equation of the circle.

2. Write the equation of a circle given the radius or point on the circle.

a) $r = 3$

b) $r = 50$

c) $P(8, -5)$

d) $Q(-11,23)$

3. Determine whether the following points or inside, on, or outside the circle $x^2 + y^2 = 65$

a) $(-4,7)$

b) $(6, -6)$

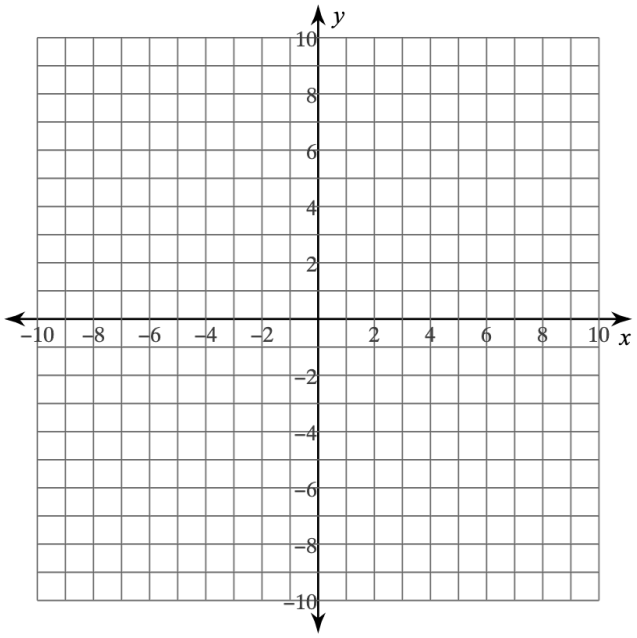
c) $(8, -1)$

d $(-3,6)$

4. Given the circle $x^2 + y^2 = 49$:

a) Determine the radius

b) State the x and y intercepts



c) Sketch the circle on the graph.

5. Points $(a, 5)$ and $(9, b)$ are on the circle $x^2 + y^2 = 125$. Determine the possible values of *a* and *b*. Round to one decimal place if necessary.

6. A satellite orbits Earth on a path with $x^2 + y^2 = 45{,}000{,}000$. Another satellite, in the same place, is currently located at $(12504, 16050)$. Explain how you would determine whether the second satellite is inside or outside the orbit of the first satellite (and is it inside or outside?). NOTE: This question is made up as objects go around Earth using an elliptical orbit, not circular.

Verifying Geometric Figures

1. Show that the line segment joining points $P(1,4)$ and $Q(5,5)$ is parallel to the line segment joining points $R(3,-4)$ and $S(7,-3)$.

2. Show that TU, $T(-1,7)$ and $U(3,5)$, is perpendicular to VW, $V(-4,1)$ and $W(-1,7)$.

3. Prove what type of triangle is formed by $J(2,5)$, $K(5,-2)$, and $L(-1,-2)$.

4. Show that triangle ABC is a right scalene triangle with points $A(-2,2)$, $B(-1,-2)$, and $C(7,0)$.

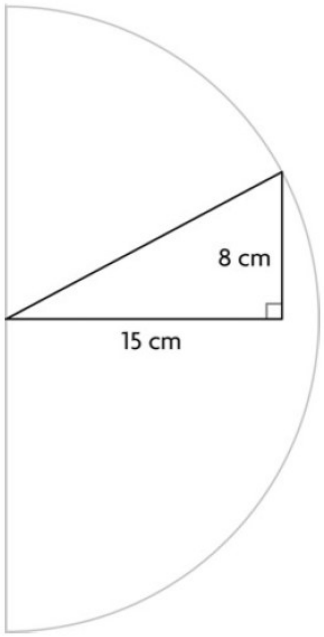
5. A polygon is defined by points $A(-5,1)$, $B(5,3)$, $C(2,-1)$, and $D(-8,-3)$. Show that the polygon is a parallelogram.

6. Determine the type of quadrilateral described by $P(-5,1)$, $Q(3,3)$, $R(4,-1)$, and $S(-4,-3)$.

Math 10D – Analytic Geometry Extra Practice

1. Which of these statements is not true?
   i. A rectangle is a special parallelogram
   ii. A square is a special rhombus
   iii. A rhombus is a special square
   iv. A rhombus is a special kite

2. Calculate the radius of the given semi-circle.



3. A circle has center $C(0,0)$ and passes through the point $A(2,6)$. What is the radius of this circle? Write the equation of the circle.

4. Quadrilateral PQRS has vertices at P(1, 7), Q(6, 8), R(7, 1), and S(3, -1).

Is PQRS a parallelogram? Explain how you know.

5. The following points are the vertices of triangles. Determine whether each triangle is scalene, isosceles, or equilateral. Calculate each side length to check your prediction.

a) $G(-1, 3)$, $H(-2, -2)$, $I(2, 0)$ b) $J(2, 5)$, $K(5, -2)$, $L(-1, -2)$

6. A quadrilateral has vertices at $W(-3, 2)$, $X(2, 4)$, $Y(6, -1)$, and $Z(1, -3)$
a) Determine the length and slope of each side of the quadrilateral.
b) Based on your calculations for part a), what type of quadrilateral is *WXYZ*? Explain.
c) Determine the difference in the lengths of the two diagonals of *WXYZ*.

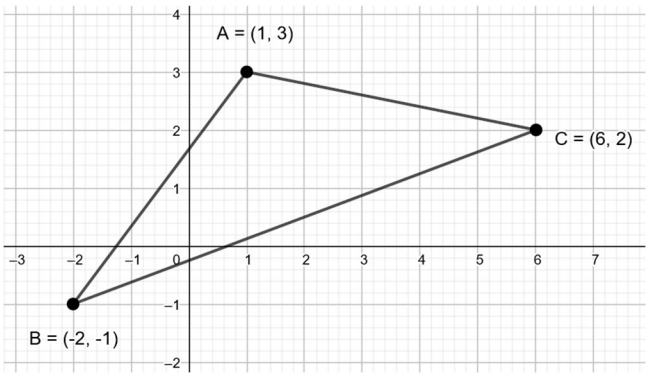
7. Determine the equation of the lines that
   i. passes through (5, -3) and (8, 6)
   ii. is perpendicular to $y = -3x + 2$ and passes through (3,1)
   iii. is parallel to the line $2x - 5y = 10$ and passes through $(10,20)$

8. Determine the PoI for the systems:

a) $3y - x = 12$
$2x + 4y = 7$

b) $y = 2x - 5$
$3x - 2y = 7$

9. a) Determine the equation of the median from the vertex B in the triangle pictured.
b) Draw the *midsegment* (you may need to look up what a midsegment is) between sides $\overline{AB}$ and $\overline{BC}$. Show that the midsegment is parallel to side $\overline{AC}$.
c) Determine the length of the altitude from vertex A (this will require a lot of work).



10. The corners of a new park have the coordinates S(-5, 1), T(5, -4), U(1, -5), and V(-5, -2). What shape is the park? Justify with proper reasoning using analytic geometry and show your working. Use GeoGebra to verify your solution.

***** Use GeoGebra to construct a kite. Use the **Measure** feature on GeoGebra to prove that your construction actually is a kite. (measure side lengths and angles – you will need to open "More" under tools). Snip your construction and post it on Edsby using the submit button created for it.