

(A) Lesson Context

BIG PICTURE of this UNIT:	<ul style="list-style-type: none"> • mastery with algebraic skills to be used in our work with co-ordinate geometry (midpoint, length, slope) • understanding various geometric properties of quadrilaterals & triangles • how do you really “prove” that something is “true”?
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(B) Lesson Objectives:

- a. Develop proficiency in analytic/algebraic/technological determination of midpoints of line segments
- b. Apply the use of midpoints and length to problem solving questions, both context based and geometry based

PART 1 – Skills REVIEW/EXPLORTION

1. 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?
2. The endpoints of the diameter of a circle are $A(-1, 1)$ and $B(2.5, -3)$. Determine the coordinates of the centre of the circle.
3. In a video game, three animated characters are programmed to run out of a building at $F(1, -1)$ and head in three different directions. After 2 s, Animal is at $A(22, 18)$, Beast is at $B(-3, 35)$, and Creature is at $C(7, -29)$. Which character ran farthest?
4. A committee is choosing a site for a county fair. The site needs to be located the same distance from the two main towns in the county. On a map, these towns have coordinates $(3, 10)$ and $(13, 4)$. Determine an equation for the line that shows all the possible sites for the fair.
5. 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?
6. A triangle has vertices at $A(2, -2)$, $B(-4, -4)$, and $C(0, 4)$.
 - a) Draw the triangle, and determine the coordinates of the midpoints of its sides.
 - b) Draw the median from vertex A , and determine its equation.

PART 2 – Skills PRACTICE/Applications & GEOMETRY Contexts

- Which of these points is closest to point $A(-3.2, 5.6)$: $B(1.8, -4.3)$, $C(0.7, 8.9)$, or $D(-7.6, 3.9)$? Justify your decision.
- A quadrilateral has vertices at $P(1, 3)$, $Q(6, 5)$, $R(8, 0)$, and $S(3, -2)$. Determine whether the diagonals have the same midpoint.
- Calculate the distance between each line and the point. Round your answer to one decimal place.
 - $y = 4x - 2$, $(-3, 3)$
 - $2x + 3y = 6$, $(7, 6)$
- Determine an equation for the perpendicular bisector of a line segment with each pair of endpoints.
 - $C(-2, 0)$ and $D(4, -4)$
 - $L(-2, -4)$ and $M(8, 4)$
- A new amusement park is going to be built near two major highways. On a coordinate grid of the area, with the scale 1 unit represents 1 km, the park is located at $P(3, 4)$. Highway 2 is represented by the equation $y = 2x + 5$, and Highway 10 is represented by the equation $y = -0.5x + 2$. Determine the coordinates of the exits that must be built on each highway to result in the shortest road to the park.
- A triangle has vertices at $P(7, 7)$, $Q(-3, -5)$, and $R(5, -3)$.
 - Determine the coordinates of the midpoints of the three sides of $\triangle PQR$.
 - Calculate the slopes of the **midsegments** of $\triangle PQR$.
 - Calculate the slopes of the three sides of $\triangle PQR$.
 - Compare your answers for parts b) and c). What do you notice?
- A coordinate grid is superimposed on the plan of a new housing development. A fibre-optic cable is being laid to link points $A(-18, 12)$, $B(-8, 1)$, $C(3, 4)$, and $D(15, 7)$ in a run beginning at A and ending at D . If one unit on the grid represents 2.5 m, how much cable is required?
- Determine the equations of the medians of a triangle with vertices at $K(2, 5)$, $L(4, -1)$, and $M(-2, -5)$.
- A quadrilateral has vertices at $W(-7, -4)$, $X(-3, 1)$, $Y(4, 2)$, and $Z(-2, -7)$. Two lines are drawn to join the midpoints of the non-adjacent sides in the quadrilateral. Determine the coordinates of the point of intersection of these lines.

Higher Level Extension Work

1. $\triangle ABC$ has vertices at $A(1, 2)$, $B(4, 8)$, and $C(8, 4)$.
 - a) $\triangle ABC$ is translated so that vertex A' is on the x -axis and vertex B' is on the y -axis. Determine the coordinates of the translated triangle, $\triangle A'B'C'$.
 - b) $\triangle DEF$ has vertices at $D(-1, 1)$, $E(-2, 6)$, and $F(-8, 3)$. Is $\triangle DEF$ congruent to $\triangle ABC$? Justify your answer.

2. A triangle has vertices at $S(6, 6)$, $T(-6, 12)$, and $U(0, -12)$. SM is the median from vertex S .
 - a) Determine the coordinates of the point that is two-thirds of the way from S to M that lies on SM .
 - b) Repeat part a) for the other two medians, TN and UR .
 - c) Show that the three medians intersect at a common point. What do you notice about this point?
 - d) Do you think the relationship you noticed is true for all triangles? Explain.

3. A point is one-third of the way from point $A(1, 7)$ to point $B(10, 4)$. Determine the coordinates of this point. Explain the strategy you used.