$P(-2,0)$

10) a) $M_{QR} = (4.5, 1.5)$

slope between P and M_{QR}

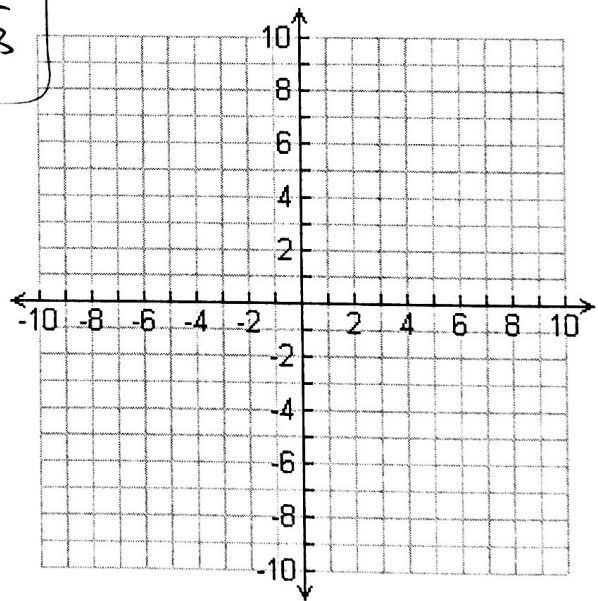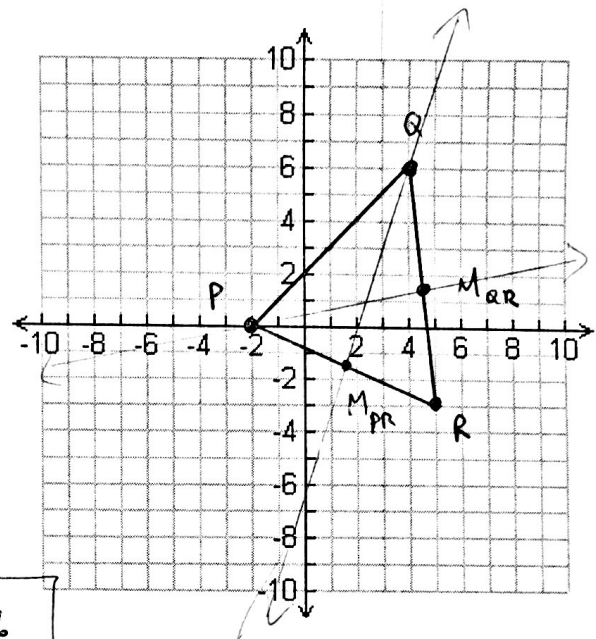$$= \frac{1.5 - 0}{4.5 - (-2)} = \frac{1.5}{6.5} = \frac{3}{13}$$

$$y = \frac{3}{13}x + b$$

$$0 = \frac{3}{13}(-2) + b$$

$$0 = \frac{-6}{13} + b$$

$$\frac{6}{13} = b$$

$$\boxed{y = \frac{3}{13}x + \frac{6}{13}}$$

b) $Q(4,6)$ $M_{PR} = (1.5, -1.5)$

slope between Q and M_{PR}

$$= \frac{-1.5 - 6}{1.5 - 4} = \frac{-7.5}{-2.5} = 3$$

$$y = 3x + b$$

$$6 = 3(4) + b$$

$$6 = 12 + b$$

$$-6 = b$$

$$\boxed{y = 3x - 6}$$

16) $M_{PQ} = (-1, 2)$

$m_{PQ} = \dfrac{6 - (-2)}{3 - (-5)} = \dfrac{8}{8} = 1$

$m_{\perp} = -1$

$y = -x + b$

~~$6 = -3 + b$~~ $\Big\}$ $2 = -(-1) + b$

~~$2 = -x + b$~~ $2 = 1 + b$

$\boxed{y = -x + 1}$ $\leftarrow$ $1 = b$

$\cancel{\#}$

$Q\ (3, 6)$

M_{PQ}

$P(-5, -2)$
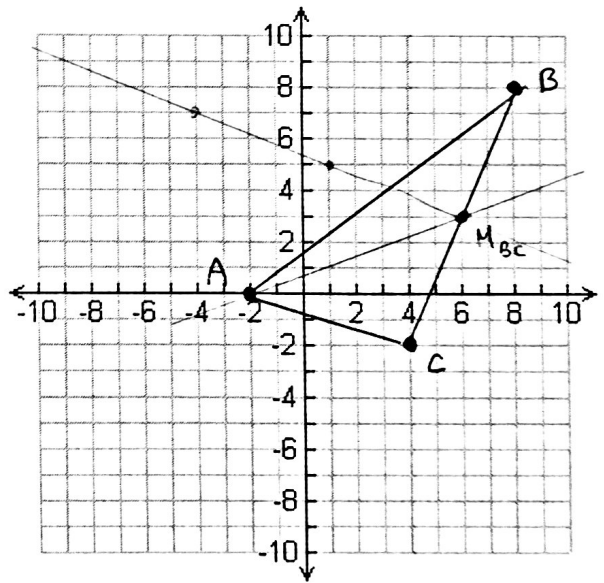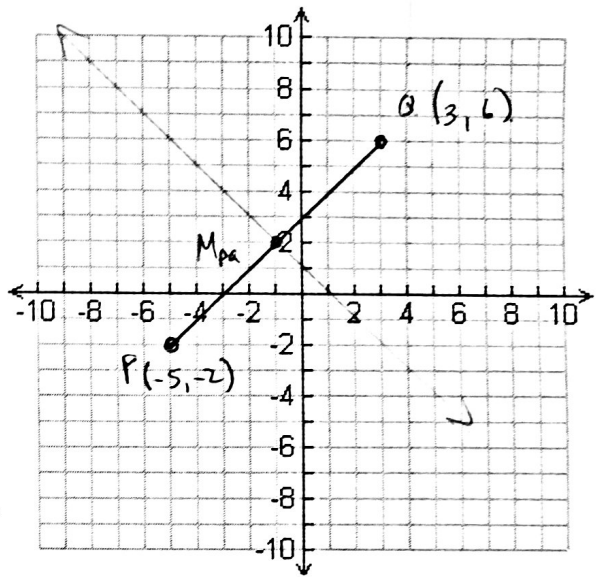
19) a) $M_{BC} = (6, 3)$

$m = \dfrac{3 - 0}{6 - (-2)} = \dfrac{3}{8}$

$y = \dfrac{3}{8} x + b$

$0 = \dfrac{3}{8}(-2) + b$

$0 = -\dfrac{6}{8} + b$

$b = 3/4$

$\boxed{y = \dfrac{3}{8} x + 3/4}$

B

A

M_{BC}

C

b) $m_{BC} = \dfrac{8 - (-2)}{8 - 4} = \dfrac{10}{4} = \dfrac{5}{2}$ $m_{\perp} = \dfrac{-2}{5}$

$y = -\dfrac{2}{5} x + b$

$3 = \dfrac{-2}{5}(6) + b$

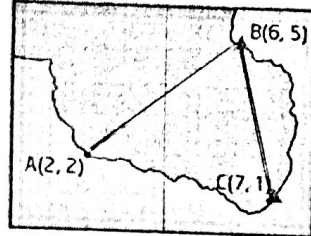$3 = \dfrac{-12}{5} + b$

$\dfrac{15}{5} + \dfrac{12}{5} = b$

$\dfrac{27}{5} = b$

$\boxed{y = \dfrac{-2}{5} x + \dfrac{27}{5}}$

How can we use coordinates to calculate distances?

Jan and Tara are planning a canoe trip in Georgian Bay. The dock where they will launch the canoe is at point A(2, 2) on their map. The campsite where they will stay the first night is at B(6, 5), and the campsite for the second night is at C(7, 1).

How far will they paddle all together?

* 1 square = 1 km.

a) Draw the points A and B on the grid to the right. Form a right angle triangle between them. We can use the rise and run to find the length!
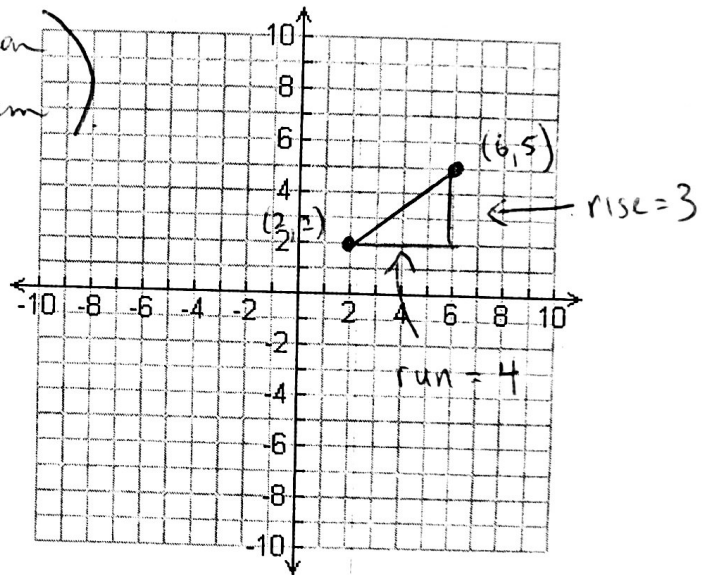
$$d^2 = run^2 + rise^2$$ (Pythagorean Theorem)

$$= 4^2 + 3^2$$

$$= 25$$

$$d = \sqrt{25}$$

$$d = 5 \text{ km}$$

b) Draw points B and C on the grid to the right. Here, will use a similar approach, but use our formulas for rise and run to determine the length.

Formula:

$$d^2 = run^2 + rise^2$$

$$d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

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

$$= \sqrt{(7-6)^2 + (1-5)^2}$$

$$= \sqrt{1^2 + (-4)^2}$$
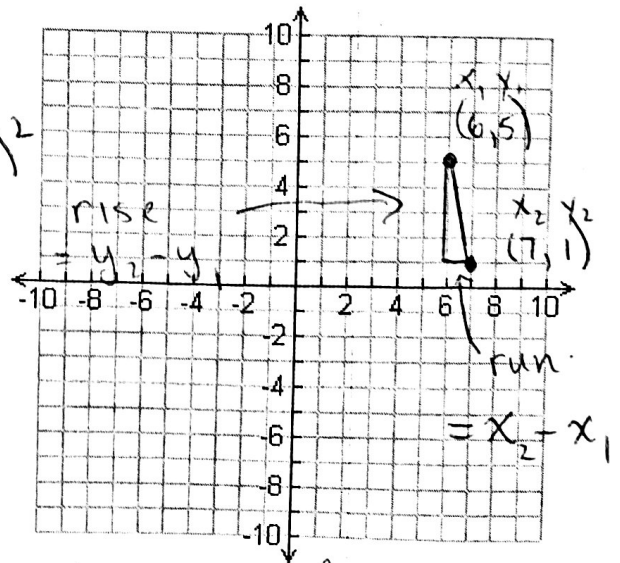
$$= \sqrt{1 + 16}$$

$$= \sqrt{17} \quad \text{exact}$$

$$\doteq 4.12 \text{ km}$$

Conclusion:

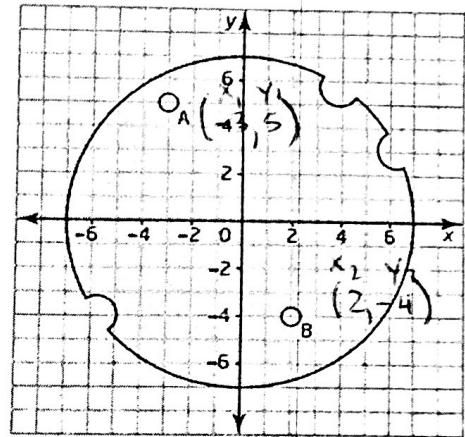They travelled 5 + 4.12

= 9.12 km.

Example: To make round parts, programmable machine tools often use a coordinate system with the origin at the centre of the part. How far apart are the centres of the mounting holes A and B in this cam? The coordinates are in centimetres. Round your answer to the nearest tenth.

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

$$= \sqrt{(2 - (-3))^2 + (-4 - 5)^2}$$

$$= \sqrt{5^2 + (-9)^2}$$

$$= \sqrt{106} \doteq 10.3 \text{ cm}$$

Example: Comparing distances

An air ambulance service uses a grid system to help estimate flying times and fuel requirements. Coordinates on this grid are distances in kilometres east and north of a reference point on the lower left corner of a map of northern Ontario. A helicopter ambulance picks up a patient at point P(96, 197).

The nearest hospitals that can provide the treatment the patient needs are in Timmins at T(200, 296) and Sudbury at S(232, 80).

a) To which hospital should the helicopter take the patient?

b) List any assumptions you made for your answer.
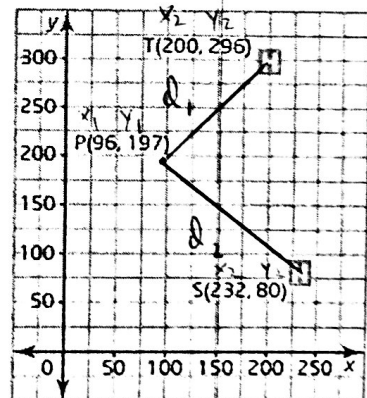
$$d_1 = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(200 - 96)^2 + (296 - 197)^2}$$

$$= \sqrt{104^2 + 99^2}$$

$$= \sqrt{20,617}$$

$$= 143.6 \text{ km}$$

$$d_2 = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(232 - 96)^2 + (80 - 197)^2}$$

$$= \sqrt{136^2 + (-117)^2}$$

$$= \sqrt{32,185}$$

$$\doteq 179.4 \text{ km}$$

↖ Go to Timmins!