

Part A

Answers Thinking Problems

1.  $m_{\perp} = -\frac{1}{2}$        $y = -\frac{1}{2}(x-3) + 5$

$$y = -\frac{1}{2}x + \frac{3}{2} + \frac{10}{2}$$

$$y = -\frac{1}{2}x + \frac{13}{2}$$

POI

$$-\frac{1}{2}x + \frac{13}{2} = 2x - 7$$

$$-x + 13 = 4x - 14$$

$$-5x = -27$$

$$x = \frac{27}{5}$$

Sub  $x = \frac{27}{5}$  into  $y = 2x - 7$

$$y = 2\left(\frac{27}{5}\right) - 7$$

$$y = \frac{54}{5} - \frac{35}{5}$$

$$y = \frac{19}{5}$$

$\therefore$  POI is  $\left(\frac{27}{5}, \frac{19}{5}\right)$  & point is  $(3, 5)$

$$d = \sqrt{\left(3 - \frac{27}{5}\right)^2 + \left(5 - \frac{19}{5}\right)^2}$$

$$d = \sqrt{\left(-\frac{12}{5}\right)^2 + \left(\frac{6}{5}\right)^2}$$

$$d = \sqrt{\frac{180}{5}}$$

$$d = 2.7 \text{ units} \quad \checkmark$$

$$2. m_{\perp} = \frac{1}{2}$$

$$y = \frac{1}{2}(x+4) + 1$$

$$y = \frac{1}{2}x + 3$$

POI

$$\frac{1}{2}x + 3 = -2x + 6$$

$$x + 6 = -4x + 12$$

$$5x = 6$$

$$x = \frac{6}{5}$$

$$\text{Sub } x = \frac{6}{5} \text{ in } y = \frac{1}{2}x + 3$$

$$y = \frac{1}{2}\left(\frac{6}{5}\right) + 3$$

$$y = \frac{18}{5}$$

$\therefore$  POI is  $\left(\frac{6}{5}, \frac{18}{5}\right)$  distance to  $(-4, 1)$

$$d = \sqrt{\left(\frac{6}{5} + 4\right)^2 + \left(\frac{18}{5} - 1\right)^2}$$

$$= \sqrt{\left(\frac{26}{5}\right)^2 + \left(\frac{13}{5}\right)^2}$$

$$= 5.8 \text{ units}$$

$$3. m_+ = -3 \quad (0, -4)$$

$$y = -3(x) - 4.$$

$$y = -3x - 4.$$

$$\begin{aligned} \text{POI} \quad -3x - 4 &= \frac{1}{3}x + 5 \\ -9x - 12 &= x + 15 \\ -27 &= 10x \\ x &= -\frac{27}{10} \end{aligned}$$

$$\text{Sub } x = -\frac{27}{10} \text{ into } y = -3x - 4$$

$$y = -3\left(-\frac{27}{10}\right) - 4$$

$$y = \frac{81}{10} - \frac{40}{10}$$

$$y = \frac{41}{10}$$

$$\text{POI is } \left(-\frac{27}{10}, \frac{41}{10}\right) = (-2.7, 4.1)$$

$$d = \sqrt{(2.7)^2 + (8.1)^2}$$

$$= \sqrt{7.29 + 65.61}$$

$$d = 8.5 \text{ units}$$

d

$$4. \quad m_{\perp} = \frac{4}{3} \quad (-4, 1)$$

$$y = \frac{4}{3}(x+4) + 1$$

$$y = \frac{4}{3}x + \frac{16}{3} + \frac{3}{3}$$

$$y = \frac{4}{3}x + \frac{19}{3}$$

POI  $\frac{4}{3}x + \frac{19}{3} = -\frac{3}{4}x + 6$

$$16x + 76 = -9x + 72$$

$$25x = -4$$

$$x = -\frac{4}{25}$$

Sub  $x = -\frac{4}{25}$  into  $y = \frac{4}{3}x + \frac{19}{3}$

$$y = \frac{4}{3}\left(-\frac{4}{25}\right) + \frac{19}{3}$$

$$y = -\frac{16}{75} + \frac{475}{75}$$

$$y = \frac{459}{75}$$

POI is  $\left(-\frac{4}{25}, \frac{459}{75}\right)$

$$d = \sqrt{\left(-\frac{4}{25} + 4\right)^2 + \left(1 - \frac{459}{75}\right)^2}$$

$$= \sqrt{\left(\frac{96}{25}\right)^2 + \left(\frac{384}{75}\right)^2}$$

$$= \sqrt{14.7 + 26.2}$$

$$= 40.9 \text{ units.}$$

$$5. \quad m_{\perp} = -\frac{1}{4} \quad (7, 0)$$

$$y = -\frac{1}{4}(x-7)$$

$$y = -\frac{1}{4}x + \frac{7}{4}$$

POI  $-\frac{1}{4}x + \frac{7}{4} = 4x - 7$

$$-x + 7 = 16x - 28$$

$$35 = 17x$$

$$\frac{35}{17} = x$$

Sub  $x = \frac{35}{17}$  into  $y = 4x - 7$

$$y = 4\left(\frac{35}{17}\right) - \frac{119}{17}$$

$$y = \frac{140 - 119}{17}$$

$$y = \frac{21}{17}$$

POI  $\left(\frac{35}{17}, \frac{21}{17}\right)$

$$d = \sqrt{\left(7 - \frac{35}{17}\right)^2 + \left(\frac{21}{17}\right)^2}$$

$$= \sqrt{\frac{(84)^2 + 441}{17}}$$

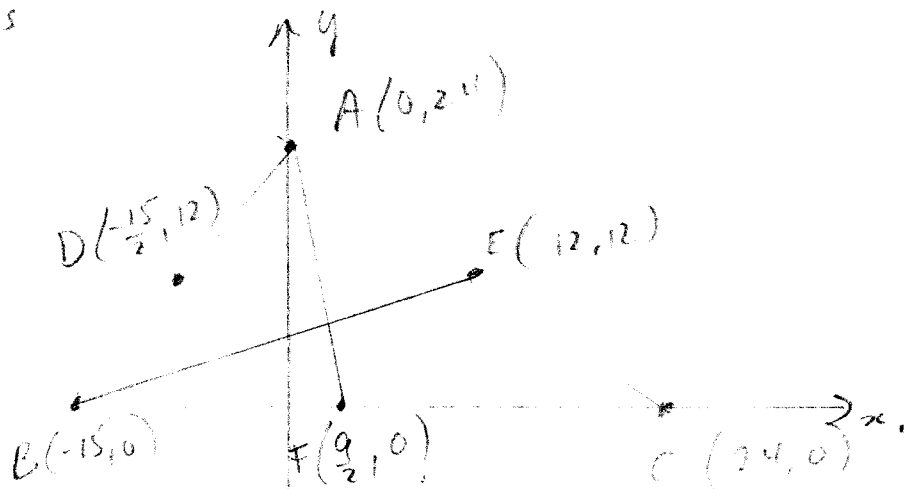
$$\approx 5.1 \text{ units}$$

## Part B Answers

$$M_{AB} = D\left(-\frac{15}{2}, 12\right)$$

$$M_{AC} = E(12, 12)$$

$$M_{BC} = F\left(+\frac{9}{2}, 0\right)$$



Find PoI of AF and BE to find centroid

$$m_{BE} = \frac{12}{27} = \frac{4}{9}$$

$$y = \frac{4}{9}(x+15) + 0$$

$$y = \frac{4}{9}x + \frac{20}{3} \quad (1)$$

$$m_{AF} = \frac{24}{-\frac{9}{2}} = 24y - \frac{2}{9}$$
$$= -\frac{16}{3}$$

$$y = -\frac{16}{3}(x) + 24$$

$$y = -\frac{16}{3}x + 24 \quad (2)$$

$$\frac{4}{9}x + \frac{20}{3} = -\frac{16}{3}x + 24$$

$$[ \times 9 ] \quad 4x + 60 = -48x + 216$$

$$52x = 156$$

$$x = 3$$

Sub  $x = 3$  into (1)

$$y = \frac{4}{9}(3) + \frac{20}{3}$$

$$y = \frac{24}{3}$$

$$y = 8$$

$$\therefore \text{Centroid} = (3, 8)$$