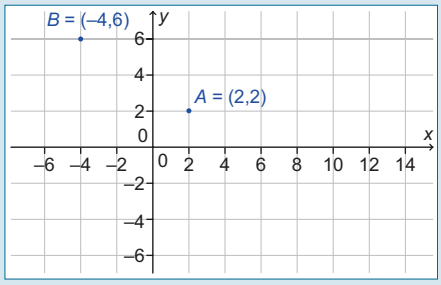
Chapter 20 Exercise 20.1

Q. 1. (i)



(ii) $C\left(\frac{2-4}{2},\frac{2+6}{2}\right) = (-1,4)$

(iii) $|AC| = \sqrt{(-1-2)^2 + (4-2)^2}$

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

$= \sqrt{9+4}$

$= \sqrt{13}$

$|CB| = \sqrt{(-1+4)^2 + (4-6)^2}$

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

$= \sqrt{9+4}$

$= \sqrt{13}$

$\therefore |AC| = |CB|$

(iv) Slope of $AB = \frac{6-2}{-4-2} = \frac{4}{-6} = \frac{-2}{3}$

$y - 2 = -\frac{2}{3}(x-2)$

$3y - 6 = -2(x-2)$

$3y - 6 = -2x + 4$

$2x + 3y - 10 = 0$

(v) AB cuts the y-axis at $x = 0$.

$0 + 3y - 10 = 0$

$3y = 10$

$y = \frac{10}{3}$

$|AB|$ cuts the y-axis at $\left(0,\frac{10}{3}\right)$.

(vi) AB cuts the x-axis at $y = 0$

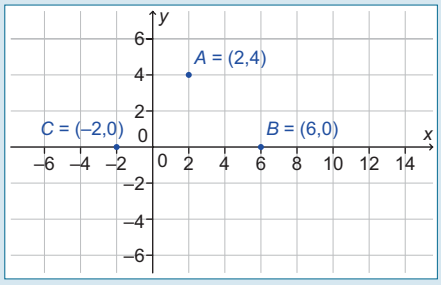
$2x + 3(0) - 10 = 0$

$2x = 10$

$x = 5$

AB cuts the x-axis at $(5,0)$.

Q. 2. (i)



(ii) $M\left(\frac{6-2}{2},\frac{0+0}{2}\right) = M(2,0)$

(iii) AB: slope $= \frac{0-4}{6-2} = \frac{-4}{4} = -1$

(iv) $y - y_1 = m(x - x_1)$

$y - 4 = -1(x-2)$

$y - 4 = -x + 2$

$x + y - 6 = 0$

(v) $x + y = 6$

$x - y = -2$

$2x = 4$

$x = 2$

$2 + y = 6$

$y = 4$

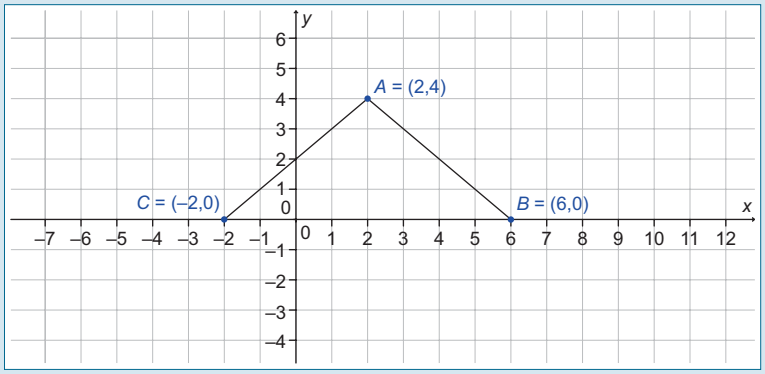
$(2,4)$

(vi) $h = 4$ base $= 8$

Area $= \frac{1}{2} \times b \times \perp h$

$= \frac{1}{2} \times 8 \times 4$

$= 16$ units^2

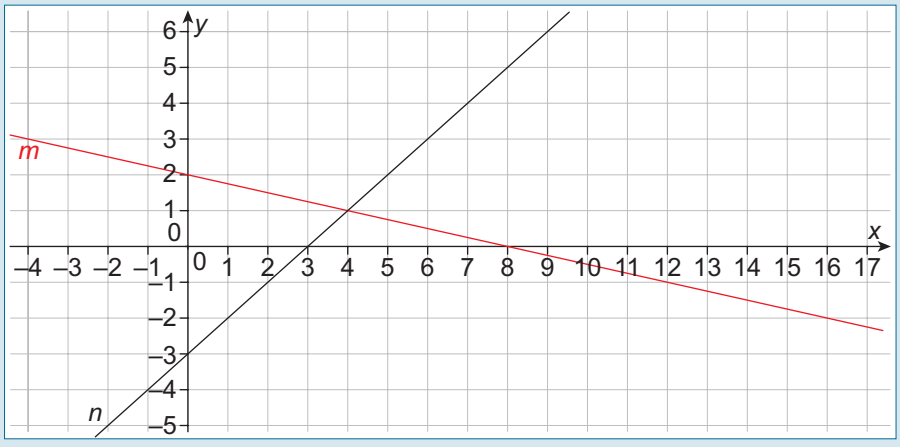


Q. 3. (i) $m: x + 4y - 8 = 0$

$$4y = -x + 8$$

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

Slope $= \frac{-1}{4}$, $C = 2$



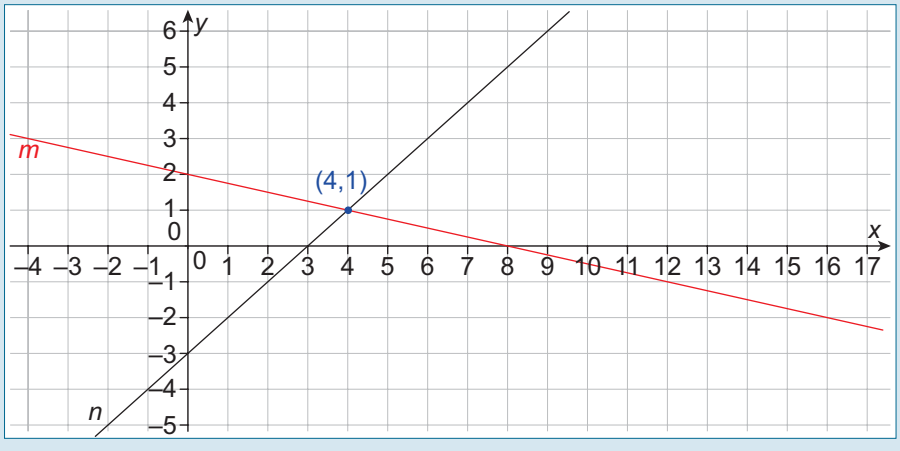
$n: x - y - 3 = 0$

$$-y = -x + 3$$

$$y = x - 3$$

Slope $= 1$, $C = -3$

(ii)



(4,1)

(iii) $x + 4y - 8 = 0$

$\ominus x \oplus y \oplus 3 = 0$

$$5y - 5 = 0$$

$$5y = 5$$

$$y = 1$$

$x - 1 - 3 = 0$

$$x - 4 = 0$$

$$x = 4$$

(4,1)

(iv) At y-axis, $x = 0$

$$0 + 4y - 8 = 0$$

$$4y = 8$$

$$y = 2$$

(0,2)

Q. 4. (i) $2x - y + 3 = 0$

$-y = -2x - 3$

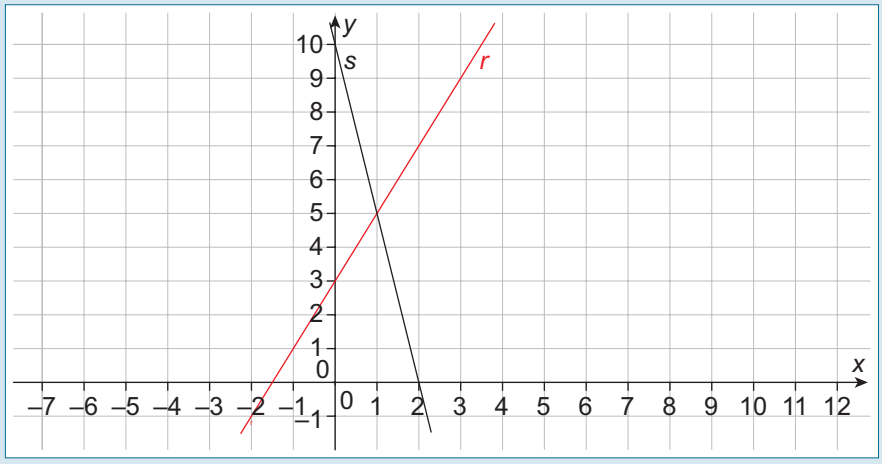
$y = 2x + 3$

Slope $= 2$, $C = 3$

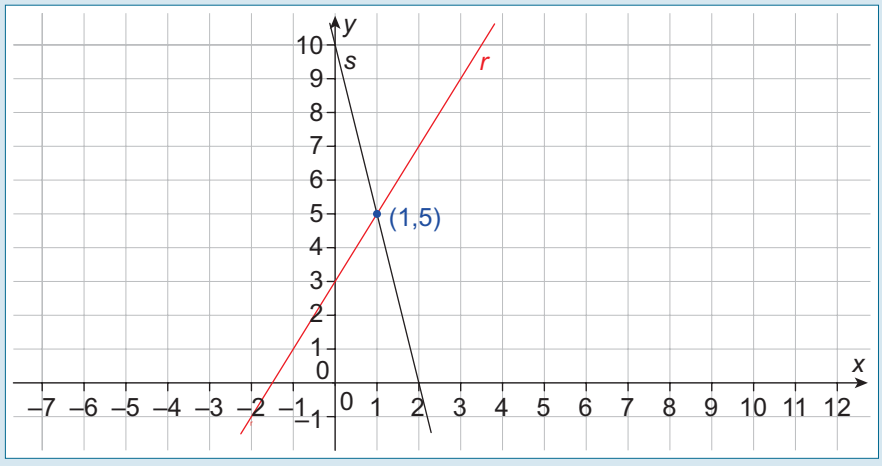
$5x + y - 10 = 0$

$y = -5x + 10$

Slope $= -5$, $C = 10$



(ii)



(1,5)

(iii) $5x + y - 10 = 0$

$2x - y + 3 = 0$

$7x - 7 = 0$

$7x = 7$

$x = 1$

$5(1) + y - 10 = 0$

$y - 5 = 0$

$y = 5$

(1,5)

(iv) At x-axis, $y = 0$

$2x - 0 + 3 = 0$

$2x = -3$

$x = \frac{-3}{2}$

$\left(\frac{-3}{2}, 0\right)$

Q. 5. (i) $3x + 2y = 18$

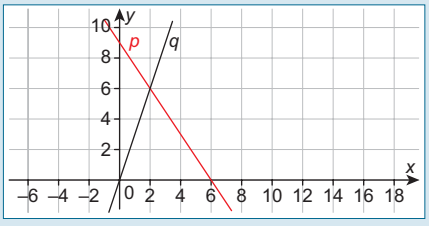
$2y = -3x + 18$

$y = \frac{-3}{2}x + 9$

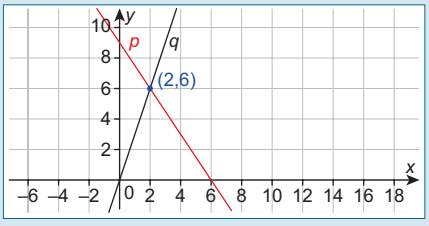
Slope $= \frac{-3}{2}$, $c = 9$

$y = 3x$

Slope $= 3$, $c = 0$



(ii)



(2,6)

(iii) $3x + 2y = 18$

$3x + 2(3x) = 18$

$3x + 6x = 18$

$9x = 18$

$x = 2$

$y = 3x$

$y = 3(2)$

$y = 6$

(2,6)

Q. 6. (i) $d = \sqrt{(5+3)^2 + (4+2)^2}$

$= \sqrt{8^2 + 6^2}$

$= \sqrt{100}$

$= 10$ units

(ii) $10 \times \frac{1}{10} = 1$ km

(iii) $T = \frac{D}{S} = \frac{1}{2.5} = \frac{2}{5}$ hr $= 24$ minutes

Q. 7. (i) h: $3x + y = 5$

$(1,2) \Rightarrow \quad 3(1) + 2 = 5?$

$3 + 2 = 5?$

$5 = 5$ ✓

$\therefore (1,2) \in h$

(ii) $(k,0) \Rightarrow \quad 3(k) + 0 = 5$

$3k = 5$

$k = \frac{5}{3}$

(iii) Let $y = 3$

$\Rightarrow 3x + 3 = 5$

$3x = 2$

$x = \frac{2}{3}$

$\left(\frac{2}{3}, 3\right)$

Let $y = -1$

$\Rightarrow 3x - 1 = 5$

$3x = 6$

$x = 2$

$(2,-1)$

Let $y = 5$

$\Rightarrow 3x + 5 = 5$

$3x = 0$

$x = 0$

$(0,5)$

(iv) Slope $= \frac{5+1}{0-2} = \frac{6}{-2} = -3$

(v) $3x + y = 5$

$y = -3x + 5$

$m = -3$

Q. 8. (i) $y = 4x - 3$

(ii) $y = -3x + 5$

Q. 9. $(2,4) \rightarrow (3,-1) \rightarrow (4,-6)$

$a = 4$

$b = -6$

Q. 10. (i) $m = \frac{2-6}{12-4} = \frac{-4}{8} = \frac{-1}{2}$

$y - y_1 = m(x - x_1)$

$y - 6 = \frac{-1}{2}(x - 4)$

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

$2y - 12 = -x + 4$

$l_1: x + 2y = 16$

(ii) $l_2: y = -4x + 0$

$4x + y = 0$

(iii) $x + 2y = 16$

$x + 2(-4x) = 16$

$x - 8x = 16$

$-7x = 16$

$x = \frac{-16}{7}$

$y = -4\left(\frac{-16}{7}\right)$

$y = \frac{64}{7}$

$\left(\frac{-16}{7}, \frac{64}{7}\right)$

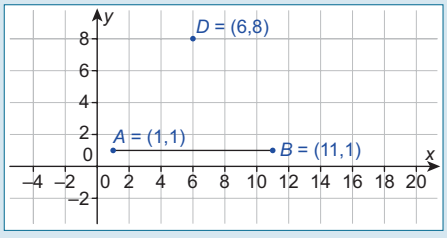
Midpoint $\left(\frac{4 - \frac{16}{7}}{2}, \frac{6 + \frac{64}{7}}{2}\right)$

$= \left(\frac{12}{14}, \frac{108}{14}\right) = \left(\frac{6}{7}, \frac{54}{7}\right)$

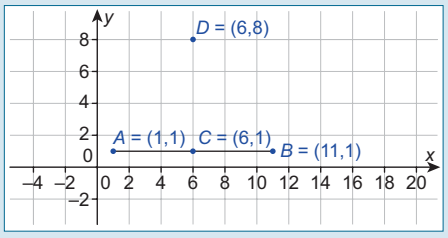
Q. 11. (a) $A(1,1)$

$B(11,1)$

(b)

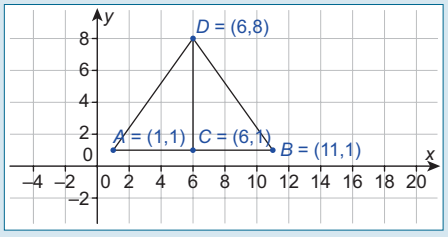


(c)



(6,1)

(d)



(6,1)

(e) $|AD| = \sqrt{(6-1)^2 + (8-1)^2}$

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

$= \sqrt{25 + 49}$

$= \sqrt{74}$

$|BD| = \sqrt{(6-11)^2 + (8-1)^2}$

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

$= \sqrt{25 + 49}$

$= \sqrt{74}$

(f) ABD is an isosceles Δ as two sides are equal in measure.

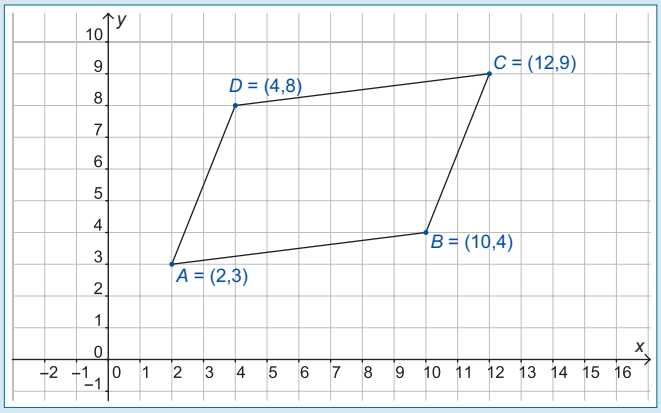
(g) $|AD| = |BD|$ shown in (e)

$|AC| = |BC|$ as C is the midpoint

$CD| = |CD|$ as it is the common side

$\therefore \Delta ACD \equiv \Delta BCD$ by SSS.

Q. 12. (i)



(ii) $|AD| = \sqrt{(4-2)^2 + (8-3)^2}$

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

$= \sqrt{4 + 25}$

$= \sqrt{29}$

$|BC| = \sqrt{(12-10)^2 + (9-4)^2}$

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

$= \sqrt{4 + 25}$

$= \sqrt{29}$

$\therefore |AD| = |BC|$

(iii) Midpoint of $[AC]$:

$E\left(\frac{2+12}{2}, \frac{3+9}{2}\right) = \left(\frac{14}{2}, \frac{12}{2}\right)$

$= (7,6)$

Midpoint of $[BD]$

$F\left(\frac{10+4}{2}, \frac{4+8}{2}\right) = \left(\frac{14}{2}, \frac{12}{2}\right)$

$= (7,6)$

$E = F$

$\therefore$ $[AC]$ and $[BD]$ bisect each other.

(iv) Yes, I can now conclude that $ABCD$ is a parallelogram as opposite sides are equal in length and the diagonals bisect each other.

Exercise 20.2

Q. 1.

Slope	Slope of parallel line	Slope of perpendicular line
$-\frac{1}{2}$	$-\frac{1}{2}$	2
$\frac{3}{4}$	$\frac{3}{4}$	$-\frac{4}{3}$
$-\frac{1}{3}$	$-\frac{1}{3}$	3
$-\frac{8}{11}$	$-\frac{8}{11}$	$\frac{11}{8}$
13	13	$-\frac{1}{13}$

Q. 2. $\frac{5}{4}$ **Q. 3.** $\frac{4}{3}$ **Q. 4.** $-\frac{1}{2}$

Q. 5. -4 **Q. 6.** $\frac{1}{3}$

Q. 7. (i) $2x + y - 8 = 0$

$y = -2x + 8$

$m = -2$

(ii) $3x - y + 6 = 0$

$-y = -3x - 6$

$y = 3x + 6$

$m = 3$

(iii) $2x - 2y = 9$

$-2y = -2x + 9$

$y = x - \frac{9}{2}$

$m = 1$

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

$x - y = \frac{4}{3}$

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

$y = x - \frac{4}{3}$

$m = 1$

(v) $2x - 3(y - 2) = 0$

$2x - 3y + 6 = 0$

$-3y = -2x - 6$

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

$m = \frac{2}{3}$

(vi) $4x = 6 - 5y$

$5y = -4x + 6$

$y = \frac{-4}{5}x + \frac{6}{5}$

$m = -\frac{4}{5}$

Q. 8. $3x + y = 6$

$y = -3x + 6$

$m = -3$

$c = 6$

Line $\perp 3x + y = 6$ has $m = \frac{1}{3}$

$\therefore$ Equation is $y = \frac{1}{3}x + 6$

$3y = x + 18$

Q. 9. $2x - y = 3$

$-y = -2x + 3$

$y = 2x - 3$

$m = 2, c = -3$

Line $\perp$ to $2x - y = 3$ has slope $-\frac{1}{2}$

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

$2y = -x - 6$

$x + 2y + 6 = 0$

Q. 10. $x + 2y = 4$

$2y = -x + 4$

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

$m = \frac{-1}{2}, c = 2$

Slope of line $\perp$ to $x + 2y = 4$ is 2

$\therefore y = 2x + 2$

Q. 11. $x - 3y + 6 = 0$

$-3y = -x - 6$

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

$m = \frac{1}{3}, c = 2$

Line $\parallel$ to $x - 3y + 6 = 0$ has slope $\frac{1}{3}$

$y - y_1 = m(x - x_1)$

$y - 4 = \frac{1}{3}(x - 2)$

$3y - 12 = x - 2$

$x - 3y + 10 = 0$

Q. 12. $2x + 3y + 6 = 0$

$3y = -2x - 6$

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

$m = \frac{-2}{3}, c = -2$

Line $\perp$ to $2x + 3y + 6 = 0$ has slope $\frac{3}{2}$

$y - y_1 = m(x - x_1)$

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

$2y + 12 = 3x - 3$

$3x - 2y - 15 = 0$

Q. 13. (i) a: $2x + 3y - 8 = 0$

$3y = -2x + 8$

$y = \frac{-2}{3}x + \frac{8}{3}$

b: $2x - 3y + 6 = 0$

$-3y = -2x - 6$

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

$m_1 m_2 = \left(\frac{-2}{3}\right)\left(\frac{2}{3}\right) \neq 1$

$\therefore a \not\perp b$

(ii) a: $-2x + 3y - 8 = 0$

$3y = 2x + 8$

$y = \frac{2}{3}x + \frac{8}{3}$

b: $2x - 3y + 14 = 0$

$-3y = -2x - 14$

$y = \frac{2}{3}x + \frac{14}{3}$

$m_1 = m_2$

$\therefore a \not\perp b$

(iii) a: $2x - 6y - 8 = 0$

$-6y = -2x + 8$

$y = \frac{1}{3}x - \frac{8}{6}$

b: $x - 3y + 1 = 0$

$-3y = -x - 1$

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

$m_1 = m_2$

$\therefore a \not\perp b$

(iv) a: $2x - 4y - 3 = 0$

$-4y = -2x + 3$

$y = \frac{1}{2}x - \frac{3}{4}$

b: $y = -2x + 10$

$m_1 m_2 = \left(\frac{1}{2}\right)(-2) = -1$

$\therefore a \perp b$

(v) a: $-2x + 3y - 3 = 0$

$3y = 2x + 3$

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

b: $3y = -2x + 10$

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

$m_1 m_2 = \left(\frac{2}{3}\right)\left(\frac{-2}{3}\right) \neq -1$

$\therefore a \perp b$

(vi) a: $y = 2x - 7$

b: $x + 2y = 3$

$2y = -x + 3$

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

$m_1 m_2 = (2)\left(\frac{-1}{2}\right) = -1$

$\therefore a \perp b$

Q. 14. (i) (1,2)

$y = 3$ is horizontal,

$\therefore$ Line $\perp$ to $y = 3$ must be vertical.

Vertical line going through (1,2) has equation $x = 1$.

(ii) It is not possible to verify as slope of $y = 3$ is 0 and slope of $x = 1$ is undefined.

Q. 15. l: $5x - y + 4 = 0$

$-y = -5x - 4$

$y = 5x + 4$

$m = 5$

Slope of $k = 5$

$y - y_1 = m(x - x_1)$

$y + 3 = 5(x - 4)$

$y + 3 = 5x - 20$

$5x - y - 23 = 0$

Q. 16. m: $3x - 6y + 11 = 0$

$-6y = -3x - 11$

$y = \frac{1}{2}x + \frac{11}{6}$

n has slope -2

$y - y_1 = m(x - x_1)$

$y - 2 = -2(x + 4)$

$y - 2 = -2x - 8$

$2x + y + 6 = 0$

Q. 17. p: $7x - y + 14 = 0$

$-y = -7x - 14$

$y = 7x + 14$

q has slope 7

$y - y_1 = m(x - x_1)$

$y - 3 = 7(x + 1)$

$y - 3 = 7x + 7$

$7x - y + 10 = 0$

Q. 18. l: $x - y + 4 = 0$

$-y = -x - 4$

$y = x + 4$

k has slope -1

$y - y_1 = m(x - x_1)$

$y - 2 = -1(x - 2)$

$y - 2 = -x + 2$

$x + y - 4 = 0$

Revision Exercises

Q. 1. (i) $m = \frac{\text{rise}}{\text{run}} = \frac{6}{5}$

(ii) $C\left(\frac{1+6}{2}, \frac{-2+4}{2}\right) = \left(3\frac{1}{2}, 1\right)$

(iii) $|AB| = \sqrt{(1-6)^2 + (-2-4)^2}$

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

$= \sqrt{25 + 36}$

$= \sqrt{61}$

(iv) Slope of $k = \frac{-5}{6}$

$C\left(3\frac{1}{2}, 1\right)$

$y - y_1 = m(x - x_1)$

$y - 1 = \frac{-5}{6}\left(x - \frac{7}{2}\right)$

$6y - 6 = -5x + \frac{35}{2}$

$12y - 12 = -10x + 35$

k: $10x + 12y - 47 = 0$

(v) At x-axis, $y = 0$

$10x - 47 = 0$

$10x = 47$

$x = 4.7$

(4.7,0)

At y-axis, $x = 0$

$12y - 47 = 0$

$12y = 47$

$y = \frac{47}{12}$ $\left(0, \frac{47}{12}\right)$

Q. 2. (i) l: $3x - 4y + 7 = 0$

$P(-1,h)$: $3(-1) - 4(h) + 7 = 0$

$-3 - 4h + 7 = 0$

$-4h + 4 = 0$

$-4h = -4$

$h = 1$

m: $4x + 3y - 24 = 0$

$Q(k,0)$: $4(k) + 3(0) - 24 = 0$

$4k - 24 = 0$

$4k = 24$

$k = 6$

(ii) $3x - 4y + 7 = 0 \quad \times 3$

$4x + 3y - 24 = 0 \quad \times 4$

$9x - 12y + 21 = 0$

$16x + 12y - 96 = 0$

$25x - 75 = 0$

$25x = 75$

$x = 3$

$3x - 4y + 7 = 0$

$3(3) - 4y + 7 = 0$

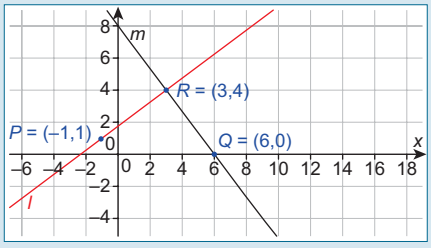
$9 - 4y + 7 = 0$

$-4y = -16$

$y = 4$

$(3,4)$

(iii)



(iv) $\angle PRQ$ is a right angle

$\Rightarrow PR \perp RQ$

$\Rightarrow l \perp m$

l: $3x - 4y + 7 = 0$

$-4y = -3x - 7$

$y = \frac{3}{4}x + \frac{7}{4}$

m: $4x + 3y - 24 = 0$

$3y = -4x + 24$

$y = \frac{-4}{3}x + 8$

$m_1 m_2 = \left(\frac{3}{4}\right)\left(\frac{-4}{3}\right) = -1$

$\therefore l \perp m$

$\therefore \angle PRQ$ is a right angle.

Q. 3. (i) $P(-1,2) \quad R(3,4)$

$M\left(\frac{-1+3}{2}, \frac{2+4}{2}\right) = M\left(\frac{2}{2}, \frac{6}{2}\right)$

$= M(1,3)$

(ii) $m = \frac{4-2}{3-(-1)} = \frac{2}{4} = \frac{1}{2}$

(iii) Line $\perp$ to $[PR]$ has slope -2

$y - y_1 = m(x - x_1)$

$y - 3 = -2(x - 1)$

$y - 3 = -2x + 2$

$2x + y - 5 = 0$

(iv) k: $x - 2y = 0$

l: $2x + y = 5 \quad \times 2$

$x - 2y = 0$

$4x + 2y = 10$

$5x = 10$

$x = 2$

$x - 2y = 0$

$2 - 2y = 0$

$-2y = -2$

$y = 1$

$N(2,1)$

Q. 4. l: $2x + 3y = -1$

(i) $3y = -2x - 1$

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

Slope of $k = \frac{3}{2}$

$y - y_1 = m(x - x_1)$

$y - 2 = \frac{3}{2}(x - 3)$

$2y - 4 = 3x - 9$

k: $3x - 2y - 5 = 0$

(ii) k and l are $\perp$

$2x + 3y = -1 \quad \times 2$

$3x - 2y = 5 \quad \times 3$

$4x + 6y = -2$

$9x - 6y = 15$

$13x = 13$

$x = 1$

$2x + 3y = -1$

$2(1) + 3y = -1$

$3y = -3$

$y = -1$

Point of intersection of k and l is $(1,-1)$

$P(3,2) \rightarrow (1,-1) \rightarrow P'(-1,-4)$

Q. 5. (i) AD: $m_1 = \dfrac{-3-(-1)}{1-2} = \dfrac{-3+1}{-1}$

$= \dfrac{-2}{-1} = 2$

BC: $m_2 = \dfrac{1-(-2)}{-2-4} = \dfrac{1+2}{-6}$

$= \dfrac{3}{-6} = \dfrac{-1}{2}$

$m_1 m_2 = 2\left(\dfrac{-1}{2}\right) = -1$

$\therefore AD \perp BC$

(ii) $|BC| = \sqrt{(-2-4)^2 + (1-(-2))^2}$

$= \sqrt{(-6)^2 + (3)^2}$

$= \sqrt{36+9}$

$= \sqrt{45}$

(iii) Area of $\Delta ABC = \dfrac{1}{2} \times b \times \perp h$

$= \dfrac{1}{2} \times \sqrt{45} \times \sqrt{5}$

$= \dfrac{1}{2}\sqrt{90}$

$= \dfrac{\sqrt{9}\,\sqrt{10}}{2} = \dfrac{3}{2}\sqrt{10}$ units^2

Q. 6. (i) l: $3x - 5y + 15 = 0$

At x-axis, $y = 0$

$3x + 15 = 0$

$3x = -15$

$x = -5$

$(-5,0) = C$

m: $3x + 4y - 12 = 0$

$3x - 12 = 0$

$3x = 12$

$x = 4$

$D = (4,0)$

(ii) $3x - 5y + 15 = 0$

$\ominus\ 3x \ominus 4y \oplus 12 = 0$

$-9y + 27 = 0$

$-9y = -27$

$y = 3$

$3x - 5(3) + 15 = 0$

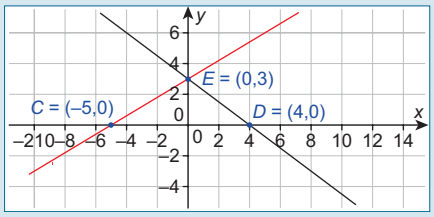
$3x - 15 + 15 = 0$

$3x = 0$

$x = 0$

$E = (0,3)$

(iii)



(iv) Area $\Delta CDE = \dfrac{1}{2} \times b \times \perp h$

$= \dfrac{1}{2} \times 9 \times 3$

$= \dfrac{27}{2}$

$= 13.5$ units^2

Q. 7. (i) $R\left(\dfrac{2-2}{2}, \dfrac{-3+1}{2}\right) = R\left(\dfrac{0}{2}, \dfrac{-2}{2}\right)$

$= R(0,-1)$

(ii) Slope $PQ = \dfrac{1-(-3)}{-2-2} = \dfrac{1+3}{-4}$

$= \dfrac{4}{-4} = -1$

$\therefore$ Slope of $k = 1$

k: $y - y_1 = m(x - x_1)$

$y + 1 = 1\,(x - 0)$

$y + 1 = x$

k: $y = x - 1$

(iii) k: $y = x - 1$

$S(3,2) \quad \Rightarrow 2 = 3 - 1?$

$2 = 2$ ✓

$\therefore S \in k$

(iv) If ΔPQS is isosceles then

$|PS| = |QS|$

$|PS| = \sqrt{(2-3)^2 + (-3-2)^2}$

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

$= \sqrt{1+25}$

$= \sqrt{26}$

$|QS| = \sqrt{(-2-3)^2 + (1-2)^2}$

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

$= \sqrt{25+1}$

$= \sqrt{26}$

$\therefore \Delta PQS$ is isosceles

Q. 8. (a) Slope of $l_1 = \frac{\text{rise}}{\text{run}} = \frac{275}{25} = \frac{11}{1} = 11$

Slope of $l_2 = \frac{\text{rise}}{\text{run}} = \frac{340}{40} = \frac{17}{2} = 8.5$

(b) At a steady speed of 60 km/hr John's car can travel 11 km per litre of fuel consumed and at a steady speed of 100 km/hr John's car travels 8.5 km per litre of fuel consumed.

(c) At 60 km/hr: $\frac{200}{11} \times 149.9$

$= 2{,}725\frac{5}{11}c$

$= €27.25$

At 100 km/hr: $\frac{200}{8.5} \times 149.9$

$= 3{,}527\frac{1}{17}c$

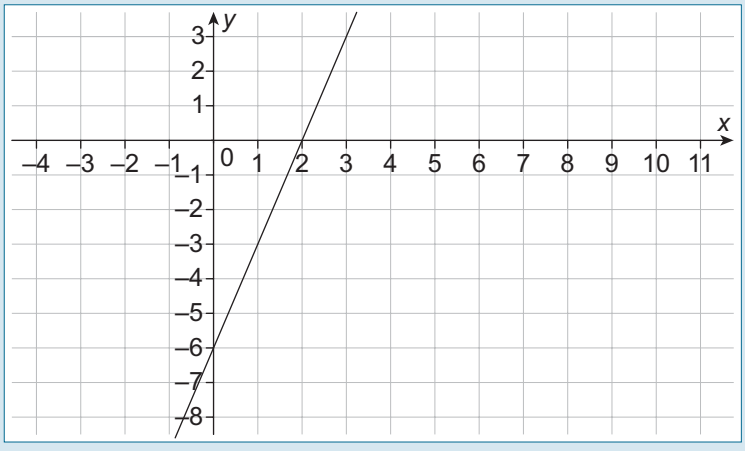
$= €35.27$

$€35.27 - €27.25 = €8.02$ cheaper

Q. 9. (a) Line 4 has greatest slope as slope = 5

(b) Lines 1 and 2 are parallel as they both have slope 3.

(c)



(d) It represents line 5.

(e) Line 6

(f) $y = x - 7$

$\ominus y = \ominus 4x \oplus 16$

$0 = -3x + 9$

$-9 = -3x$

$3 = x$

$y = 3 - 7$

$y = -4$

$(3, -4)$

(g) Line 4: If $x = 3$, $y = 3 - 7 = -4$

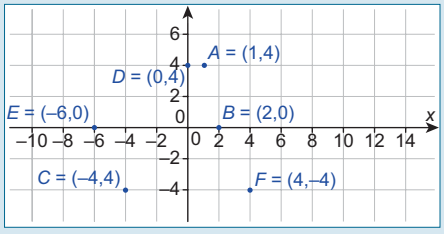
Line 6: If $x = 3$, $y = 4(3) - 16$

$= 12 - 16$

$= -4$

Q. 10. (a) $A(1,4)$

(b)



(c) Midpoint $[DF]$

$$= \left(\frac{0+4}{2}, \frac{4-4}{2}\right) = \left(\frac{4}{2}, \frac{0}{2}\right) = (2,0)$$

(d) Slope $BF = \frac{\text{rise}}{\text{run}} = \frac{-2}{1} = -2$

y intercept $BF = D = 4$

$\therefore BF: y = -2x + 4$

(e) Slope $CE = \frac{\text{rise}}{\text{run}} = \frac{-2}{1} = -2$

(f) $y - y_1 = m(x - x_1)$

$y - 0 = -2(x + 6)$

$y = -2x - 12$

$2x + y + 12 = 0$

(g) Area ΔBCE : Area ΔBCF

$1 : 1$

(h) Yes, ΔBCE and ΔBCF are congruent because they have equal area, $|BE| = |CF|$ and $|EC| = |BF|$

Q. 11. (i) k: $4x - 3y + 12 = 0$

At x-axis, $y = 0$

$4x + 12 = 0$

$4x = -12$

$x = -3$

$A(-3,0)$

At y-axis, $x = 0$

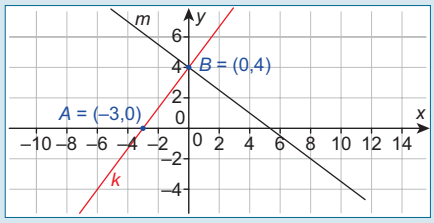
$-3y + 12 = 0$

$-3y = -12$

$y = 4$

$B(0,4)$

(ii)



(iii) k: $4x - 3y + 12 = 0$

$-3y = -4x - 12$

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

Slope of $m = \frac{-3}{4}$

m: $y - y_1 = m(x - x_1)$

$y - 4 = \frac{-3}{4}(x - 0)$

$4y - 16 = -3x$

m: $3x + 4y - 16 = 0$

Q. 12. (i)

$$\begin{array}{r} x + 2y - 10 = 0 \\ \ominus x \oplus y \ominus 2 = 0 \\ \hline 3y - 12 = 0 \end{array}$$

$3y = 12$

$y = 4$

$x - y + 2 = 0$

$x - 4 + 2 = 0$

$x - 2 = 0$

$x = 2$

$R(2,4)$

(ii) k: $x - y + 2 = 0$

$Q(3,5)$: $3 - 5 + 2 = 0$?

$0 = 0$ ✓

$\therefore Q \in k$

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

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

$= \sqrt{2}$

Q. 13. (i)

$$\begin{array}{r} x + y - 8 = 0 \\ \ominus x \oplus 2y \ominus 10 = 0 \\ \hline 3y - 18 = 0 \end{array}$$

$3y = 18$

$y = 6$

$x + y - 8 = 0$

$x + 6 - 8 = 0$

$x - 2 = 0$

$x = 2$

$R(2,6)$

(ii) $a: x + y - 8 = 0$ At x-axis, $y = 0$

$x - 8 = 0$

$x = 8$ $Q\,(8,0)$

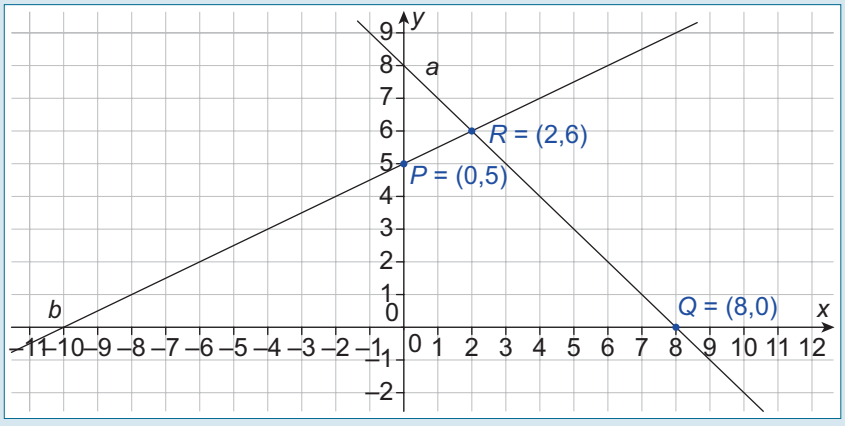
(iii) $b: x - 2y + 10 = 0$ At y-axis, $x = 0$

$-2y + 10 = 0$

$-2y = -10$

$y = 5$ $P\,(0,5)$

(iv)



(v) $T\left(\frac{0+8}{2}, \frac{5+0}{2}\right) = T\left(4, 2\frac{1}{2}\right)$

(vi) Slope PT = slope $PQ = \frac{-5}{8}$

y-intercept $= 5$

$\therefore y = mx + c$

$y = \frac{-5}{8}x + 5$

$8y = -5x + 40$

$5x + 8y = 40$

Q. 14.

Line	Slope
p	positive
q	0
r	undefined
s	negative
t	0

Q. 15. (i) $C\left(\frac{-1+5}{2}, \frac{-3-7}{2}\right) = C\left(\frac{4}{2}, \frac{-10}{2}\right)$

$= C(2,-5)$

(ii) Slope $AB = \frac{-7+3}{5+1} = \frac{-4}{6} = \frac{-2}{3}$

(iii) Slope $p = \frac{3}{2}$ $c(2,-5)$

$p: y - y_1 = m(x - x_1)$

$y + 5 = \frac{3}{2}(x - 2)$

$2y + 10 = 3x - 6$

$3x - 2y - 16 = 0$

(iv) $p: 3x - 2y - 16 = 0$

$-2y = -3x + 16$

$y = \frac{3}{2}x - 8$

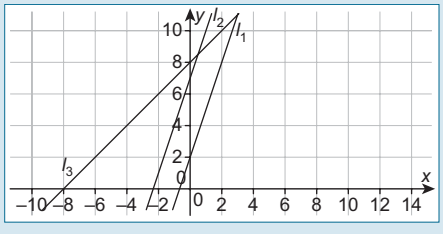
(v) y-intercept $(0,-8)$

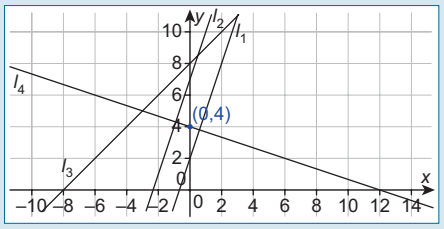
Q. 16. (a) Slope $= \frac{\text{rise}}{\text{run}} = \frac{3}{1} = 3$

y-intercept $= 2$

$\therefore y = 3x + 2$

(b)



(c) 

(d) l_4: $y = \left(\frac{-1}{3}\right)x + 4$

$(27,-4)$: $-4 = \left(\frac{-1}{3}\right)27 + 4$?

$-4 = -9 + 4$?

$-4 = -5$ ×

$\therefore (27,-4) \notin l_4$

Q. 17. (i) Slope of $AB = \frac{4-0}{0-3} = \frac{-4}{3}$

$\therefore$ Slope of $BC = \frac{3}{4}$

(ii) $B(0, 4)$ $C(8, k)$

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

$= \sqrt{(8-0)^2 + (k-4)^2}$

$= \sqrt{64 + k^2 - 8k + 16}$

$= \sqrt{k^2 - 8k + 80}$

(iii) $|BC| = 10$

$\sqrt{k^2 - 8k + 80} = 10$

$k^2 - 8k + 80 = 100$

$k^2 - 8k - 20 = 0$

$(k + 2)(k - 10) = 0$

$k = -2$ **OR** $k = 10$

as k is positive

$\therefore k = 10$

(iv) $|AB| = \sqrt{(0-3)^2 + (4-0)^2}$

$= \sqrt{9 + 16}$

$= \sqrt{25}$

$= 5$

$\therefore$ Area $ABCD = 5(10) = 50$ units^2

Q. 18. (i) Slope $AB = \frac{4-2}{3-1} = \frac{2}{2} = 1$

(ii) Slope $BC = \frac{-2-4}{9-3} = \frac{-6}{6} = -1$

$m_1 m_2 = (1)(-1) = -1$

$\therefore AB \perp BC$

(iii) $y - y_1 = m(x - x_1)$

$y - 4 = -1(x - 3)$

$y - 4 = -x + 3$

$x + y - 7 = 0$

(iv) $|AB| = \sqrt{(3-1)^2 + (4-2)^2}$

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

$= \sqrt{8}$

$= \sqrt{4}\sqrt{2}$

$= 2\sqrt{2}$

$\therefore p = 2$

(v) $|BC| = \sqrt{(9-3)^2 + (-2-4)^2}$

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

$= \sqrt{72}$

$= \sqrt{36 \times 2}$

$= 6\sqrt{2}$

$\therefore$ Area $\Delta ABC = \frac{1}{2}(2\sqrt{2})(6\sqrt{2})$

$= 6(2)$

$= 12$ units^2

Q. 19. (a) $|BC| = \sqrt{(10-3)^2 + (9-10)^2}$

$= \sqrt{49 + 1}$

$= \sqrt{50}$

$= 7.071$ km

(b) $|BE| = \sqrt{(6-3)^2 + (6-10)^2}$

$= \sqrt{9 + 16}$

$= \sqrt{25}$

$= 5$

$|BE| = |CE|$ as E is centre of a circle

$\therefore$ distance from B to E to $C = 10$ km

10 km − 7.071 km = 2.929 km

≈ 3 km

(c) Slope $AB = \frac{10 - 8.5}{3 - 1} = \frac{1.5}{2} = \frac{3}{4}$

$y - y_1 = m(x - x_1)$

$y - 10 = \frac{3}{4}(x - 3)$

$4y - 40 = 3x - 9$

$3x - 4y + 31 = 0$ is equation of Tangent Street

(d) Slope $= \frac{-4}{3}$

$y - y_1 = m(x - x_1)$

$y - 8 = \frac{-4}{3}(x - 17)$

$3y - 24 = -4x + 68$

$4x + 3y - 92 = 0$ is equation of Perpendicular Avenue

(e) $3x - 4y + 31 = 0 \quad \times 3$

$4x + 3y - 92 = 0 \quad \times 4$

$9x - 12y + 93 = 0$

$16x + 12y - 368 = 0$

$25x - 275 = 0$

$25x = 275$

$x = 11$

$3(11) - 4y + 31 = 0$

$33 - 4y + 31 = 0$

$-4y + 64 = 0$

$-4y = -64$

$y = 16$

(11,16) co-ordinates of museum

(f) From Town Hall (0,0) to intersection of Straight Road and East Drive (1,0)

1 km

Then North on Straight Road to $A(1,8.5)$

8.5 km

Then travel from A on Tangent Street to Museum (11,16)

$\sqrt{(11-1)^2 + (16-8.5)^2}$

$\sqrt{10^2 + (7.5)^2}$

$\sqrt{100 + 56.25} = \sqrt{156.25}$

$= 12.5$ km

Total distance travelled is

$1 + 8.5 + 12.5 = 22$ km

Q. 20. (a) $A(6,1) \qquad B(2,-1)$

Slope of $AB = \frac{-1-1}{2-6} = \frac{-2}{-4} = \frac{1}{2}$

$y - y_1 = m(x - x_1)$

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

$2y + 2 = x - 2$

$x - 2y - 4 = 0$

(b) At y-axis $x = 0$

$\Rightarrow -2y - 4 = 0$

$-2y = 4$

$y = -2 \qquad C(0,-2)$

(c) $|AB| = \sqrt{(2-6)^2 + (-1-1)^2}$

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

$= \sqrt{20}$

$= \sqrt{4}\sqrt{5}$

$= 2\sqrt{5}$

$|AC| = \sqrt{(0-6)^2 + (-2-1)^2}$

$= \sqrt{36 + 9}$

$= \sqrt{45}$

$= \sqrt{9}\sqrt{5}$

$= 3\sqrt{5}$

$\therefore \frac{|AB|}{|AC|} = \frac{2\sqrt{5}}{3\sqrt{5}} = \frac{2}{3}$

Q. 21.

Slope	Line
2	k
$\frac{1}{8}$	m
0	l
$-\frac{1}{4}$	j
–1	n