**1** **a** grad $l = -2$

$\therefore$ grad $m = \frac{1}{2}$

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

$2y + 2 = x - 6$

$x - 2y - 8 = 0$

**b** $x - 2(1 - 2x) - 8 = 0$

$5x - 10 = 0$

$x = 2 \quad \therefore (2, -3)$

**2** **a** grad $= \frac{5+3}{7-1} = \frac{4}{3}$

$\therefore \; y + 3 = \frac{4}{3}(x - 1) \quad [4x - 3y - 13 = 0]$

**b** subtracting, $4y - 4 = 0$

$y = 1 \quad \therefore C\,(4, 1)$

mid-point $= (\frac{1+7}{2}, \frac{-3+5}{2}) = (4, 1)$

$\therefore C$ is the mid-point of $AB$

**c** grad $m = -4$

$\therefore$ grad perp to $m = \frac{1}{4}$

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

$\therefore \; y = \frac{1}{4}x$ which passes through (0, 0)

**3** **a** $M = (q, \frac{9}{2}) = (\frac{-2+4}{2}, \frac{7+p}{2})$

$\therefore \; p = 2, \; q = 1$

**b** grad $AB = \frac{2-7}{4+2} = -\frac{5}{6}$

$\therefore$ grad perp to $AB = \frac{6}{5}$

$y - 7 = \frac{6}{5}(x + 2)$

$5y - 35 = 6x + 12$

$6x - 5y + 47 = 0$

**4** **a** $PQ^2 = 4^2 + 8^2 = 80$

$PQ = \sqrt{80} = 4\sqrt{5} \quad [k = 4]$

**b** $M = (\frac{-5-1}{2}, \frac{-2+6}{2}) = (-3, 2)$

**c** grad $MS = \frac{-1-2}{3+3} = -\frac{1}{2}$

grad $PQ = \frac{6+2}{-1+5} = 2$

grad $MS \times$ grad $PQ = -\frac{1}{2} \times 2 = -1$

$\therefore MS$ is perpendicular to $PQ$

**d** $MS = \sqrt{6^2 + 3^2} = \sqrt{45} = 3\sqrt{5}$

area $= PQ \times MS = 60$

**5** **a** grad of $2x - y + 4 = 0$ is 2

$\therefore$ grad of $l = 2$

$y + 3 = 2(x + 1) \quad [y = 2x - 1]$

**b** grad of $6x + 5y - 2 = 0$ is $-\frac{6}{5}$

$\therefore$ grad of $m = \frac{5}{6}$

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

$6y - 24 = 5x - 20$

$5x - 6y + 4 = 0$

**c** $5x - 6(2x - 1) + 4 = 0$

$10 - 7x = 0$

$x = \frac{10}{7} \quad \therefore (1\frac{3}{7}, 1\frac{6}{7})$

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

$2y - 8 = x - 2$

$x - 2y + 6 = 0$

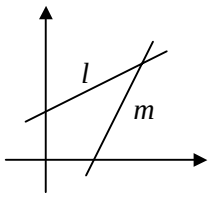
**b** $x - 2(2x - 6) + 6 = 0$

$18 - 3x = 0$

$x = 6 \quad \therefore (6, 6)$

**c** $l$ meets $y$-axis at (0, 3)

$m$ meets $x$-axis at (3, 0)




(0, 0) and (6, 6) on $y = x$

(0, 3) and (3, 0) symmetrical about $y = x$

$\therefore$ quadrilateral is a kite

**7** **a** at $A$, $y = 0$ $\therefore x = 20$

at $B$, $x = 0$ $\therefore y = 10$

$\therefore$ $A$ (20, 0), $B$ (0, 10)

**b** $l \Rightarrow \quad y = 10 - \frac{1}{2}x$

$\therefore$ grad of $l = -\frac{1}{2}$

$\therefore$ grad of $m = 2$

$m$ : $\quad y = 2x$

at $C$, $\quad 10 - \frac{1}{2}x = 2x$

$x = 4$ $\therefore$ $C$ (4, 8)

$\therefore$ area of $\Delta OAC$ : area of $\Delta OBC$

$= \frac{1}{2} \times 20 \times 8 : \frac{1}{2} \times 10 \times 4$

$= 4 : 1$

**8** **a** grad $q$ = grad $p = -\frac{3}{4}$

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

**b** grad $r = \frac{4}{3}$

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

$3y = 4x - 4$

$4x - 3y - 4 = 0$

**c** $\frac{4}{3}x - \frac{4}{3} = -\frac{3}{4}x + 7$

$16x - 16 = -9x + 84$

$25x = 100$

$x = 4$ $\therefore$ (4, 4)

$\therefore$ lies on $y = x$

**9** **a** grad $PQ = \dfrac{2-c}{9-3} = \dfrac{2-c}{6}$

grad $QR = \dfrac{11-2}{3c-9} = \dfrac{3}{c-3}$

$\angle PQR = 90°$ $\therefore$ $PQ$ perp to $QR$

$\therefore \quad \dfrac{2-c}{6} \times \dfrac{3}{c-3} = -1$

$3(2 - c) = -6(c - 3)$

$3c = 12$

$c = 4$

**b** $PQ^2 = 6^2 + 2^2 = 40$

$PQ = \sqrt{40} = 2\sqrt{10}$ $\quad [k = 2]$

**c** $QR = \sqrt{3^2 + 9^2} = \sqrt{90} = 3\sqrt{10}$

area $= \frac{1}{2} \times PQ \times QR = 30$

**10** **a** $PQ^2 = 12^2 + 9^2 = 225$

$PQ = \sqrt{225} = 15$

**b** grad $= \dfrac{12-3}{13-1} = \frac{3}{4}$

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

$4y - 12 = 3x - 3$

$3x - 4y + 9 = 0$

**c** grad $l_2 = -\frac{4}{3}$

$y - 10 = -\frac{4}{3}(x - 2)$ $\quad [4x + 3y - 38 = 0]$

**d** $l_1 \Rightarrow \quad 9x - 12y + 27 = 0$

$l_2 \Rightarrow \quad 16x + 12y - 152 = 0$

adding $\quad 25x - 125 = 0$

$x = 5$ $\therefore$ (5, 6)

**e** distance $R$ to (5, 6) $= \sqrt{3^2 + 4^2} = 5$

area $= \frac{1}{2} \times 15 \times 5 = 37\frac{1}{2}$