

- 1 **a** grad of $y = 3 - 2x$ is -2
parallel grad = -2
- b** $2x - 5y + 1 = 0 \Rightarrow y = \frac{2}{5}x + \frac{1}{5}$
grad of $y = \frac{2}{5}x + \frac{1}{5}$ is $\frac{2}{5}$
parallel grad = $\frac{2}{5}$
- c** grad of $y = 3x + 4$ is 3
perp grad = $-\frac{1}{3} = -\frac{1}{3}$
- d** $x + 2y - 3 = 0 \Rightarrow y = \frac{3}{2} - \frac{1}{2}x$
grad of $y = \frac{3}{2} - \frac{1}{2}x$ is $-\frac{1}{2}$
perp grad = $-\frac{1}{-\frac{1}{2}} = 2$
- 2 **a** grad of $y = 4x - 1$ is 4
parallel grad = 4
 $\therefore y - 7 = 4(x - 1)$
 $y = 4x + 3$
- b** grad of $y = 6 - x$ is -1
perp grad = 1
 $\therefore y - 3 = x + 4$
 $y = x + 7$
- c** grad of $x - 3y = 0$ is $\frac{1}{3}$
perp grad = -3
 $\therefore y + 2 = -3(x + 2)$
 $y = -3x - 8$
- 3 **a** grad of $2x - 3y + 5 = 0$ is $\frac{2}{3}$
parallel grad = $\frac{2}{3}$
 $\therefore y + 1 = \frac{2}{3}(x - 3)$
 $3y + 3 = 2x - 6$
 $2x - 3y - 9 = 0$
- b** grad of $3x + 4y = 1$ is $-\frac{3}{4}$
perp grad = $\frac{4}{3}$
 $\therefore y - 5 = \frac{4}{3}(x - 2)$
 $3y - 15 = 4x - 8$
 $4x - 3y + 7 = 0$
- c** grad of $3x + 5y = 6$ is $-\frac{3}{5}$
parallel grad = $-\frac{3}{5}$
 $\therefore y + 7 = -\frac{3}{5}(x + 4)$
 $5y + 35 = -3x - 12$
 $3x + 5y + 47 = 0$
- 4 **a** mid-point = $(\frac{0+8}{2}, \frac{4+0}{2})$
 $= (4, 2)$
grad = $\frac{0-4}{8-0} = -\frac{1}{2}$
perp grad = 2
 $\therefore y - 2 = 2(x - 4)$
 $y - 2 = 2x - 8$
 $2x - y - 6 = 0$
- b** mid-point = $(\frac{2+4}{2}, \frac{7+1}{2})$
 $= (3, 4)$
grad = $\frac{1-7}{4-2} = -3$
perp grad = $\frac{1}{3}$
 $\therefore y - 4 = \frac{1}{3}(x - 3)$
 $3y - 12 = x - 3$
 $x - 3y + 9 = 0$
- c** mid-point = $(\frac{-3+9}{2}, \frac{-2+1}{2})$
 $= (3, -\frac{1}{2})$
grad = $\frac{1+2}{9+3} = \frac{1}{4}$
perp grad = -4
 $\therefore y + \frac{1}{2} = -4(x - 3)$
 $2y + 1 = -8x + 24$
 $8x + 2y - 23 = 0$
- 5 **a** grad $AB = \frac{-1+3}{4+6} = \frac{1}{5}$
grad $BC = \frac{4+1}{3-4} = -5$
- b** grad $AB \times$ grad $BC = \frac{1}{5} \times -5 = -1$
 $\therefore AB$ is perpendicular to BC
 $\therefore \angle ABC = 90^\circ$
- 6 $2x - 3y + 5 = 0 \Rightarrow y = \frac{2}{3}x + \frac{5}{3} \therefore$ grad = $\frac{2}{3}$
 $3x + ky - 1 = 0 \Rightarrow y = -\frac{3}{k}x + \frac{1}{k} \therefore$ grad = $-\frac{3}{k}$
perp $\therefore \frac{2}{3} \times -\frac{3}{k} = -1$
 $k = 2$

- 7 a $\text{grad} = \frac{7-5}{1+5} = \frac{1}{3}$
 $\therefore y - 5 = \frac{1}{3}(x + 5)$
 $3y - 15 = x + 5$
 $x - 3y + 20 = 0$
- b $M = \left(\frac{-5+1}{2}, \frac{5+7}{2}\right) = (-2, 6)$
 $\text{grad } OM = \frac{6-0}{-2-0} = -3$
 $\text{grad } l \times \text{grad } OM = \frac{1}{3} \times (-3) = -1$
 $\therefore OM$ is perpendicular to l
- 8 a $p \Rightarrow y = \frac{3}{4}x + 2 \therefore \text{grad} = \frac{3}{4}$
parallel $\text{grad} = \frac{3}{4}$
 $\therefore y - 5 = \frac{3}{4}(x - 8)$
 $y = \frac{3}{4}x - 1$
- b $\text{perp grad} = -\frac{4}{3}$
 $\therefore y - 6 = -\frac{4}{3}(x + 4)$
 $3y - 18 = -4x - 16$
 $4x + 3y - 2 = 0$
- c $q \Rightarrow 3x - 4y - 4 = 0$
 $\Rightarrow 9x - 12y - 12 = 0$
 $r \Rightarrow 16x + 12y - 8 = 0$
adding, $25x - 20 = 0$
 $x = \frac{4}{5}$
 $\therefore \left(\frac{4}{5}, -\frac{2}{5}\right)$
- 9 a $\text{grad} = \frac{-5-7}{1+3} = -3$
 $\therefore y - 7 = -3(x + 3)$
 $3x + y + 2 = 0$
- b $\text{perp grad} = \frac{1}{3}$
 $\therefore l_2: y - 6 = \frac{1}{3}(x - 4)$
 $3y - 18 = x - 4$
 $x - 3y + 14 = 0$
 $l_1 \Rightarrow 9x + 3y + 6 = 0$
adding, $10x + 20 = 0$
 $x = -2$
 \therefore pt of intersection $(-2, 4)$
 \therefore dist from origin $= \sqrt{4+16} = \sqrt{20} = 2\sqrt{5}$