1   **a**   grad of $y = 3 - 2x$ is -2

       parallel grad $= -2$

     b $2x - 5y + 1 = 0 \implies y = \frac{2}{5}x + \frac{1}{5}$

       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 $x + 2y - 3 = 0 \implies y = \frac{3}{2} - \frac{1}{2}x$

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

          $= (4, 2)$

       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 $= \left(\frac{2+4}{2}, \frac{7+1}{2}\right)$

          $= (3, 4)$

       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 $= \left(\frac{-3+9}{2}, \frac{-2+1}{2}\right)$

          $= (3, -\frac{1}{2})$

       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

       $\therefore \angle ABC = 90°$

6 $2x - 3y + 5 = 0 \implies y = \frac{2}{3}x + \frac{5}{3} \quad \therefore$ grad $= \frac{2}{3}$

      $3x + ky - 1 = 0 \implies y = -\frac{3}{k}x + \frac{1}{k} \quad \therefore$ grad $= -\frac{3}{k}$

      perp $\therefore \ \ \frac{2}{3} \times -\frac{3}{k} = -1$

           $k = 2$

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

∴ $y - 5 = \frac{1}{3}(x + 5)$

$3y - 15 = x + 5$

$x - 3y + 20 = 0$

b $M = (\frac{-5+1}{2}, \frac{5+7}{2}) = (-2, 6)$

grad $OM = \frac{6-0}{-2-0} = -3$

grad l × grad $OM = \frac{1}{3} \times (-3) = -1$

∴ OM is perpendicular to l

8   **a** $p \Rightarrow y = \frac{3}{4}x + 2$ ∴ grad = $\frac{3}{4}$

parallel grad = $\frac{3}{4}$

∴ $y - 5 = \frac{3}{4}(x - 8)$

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

b   perp grad = $-\frac{4}{3}$

∴ $y - 6 = -\frac{4}{3}(x + 4)$

$3y - 18 = -4x - 16$

$4x + 3y - 2 = 0$

c $q \Rightarrow$ $3x - 4y - 4 = 0$

$\Rightarrow$ $9x - 12y - 12 = 0$

$r \Rightarrow$ $16x + 12y - 8 = 0$

adding, $25x - 20 = 0$

$x = \frac{4}{5}$

∴ $(\frac{4}{5}, -\frac{2}{5})$

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

∴ $y - 7 = -3(x + 3)$

$3x + y + 2 = 0$

b   perp grad = $\frac{1}{3}$

∴ 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, $10x + 20 = 0$

$x = -2$

∴ pt of intersection $(-2, 4)$

∴ dist from origin = $\sqrt{4+16}$ = $\sqrt{20}$ = $2\sqrt{5}$

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