1. The idea is to express every equation in the form $y = mx + c$; then the gradient is $m$ and the intercept $c$. So we solve each equation for $y$.

a. No need to solve. $m = 4$, $c = 2$.

b. $y = x - 5$, so $m = 1$, $c = -5$.

c. No need to solve. $m = -3$, $c = 6$.

d. $y = \frac{-7x - 1}{9}$, so $m = -\frac{7}{9}$, $c = -\frac{1}{9}$.

e. $y = \frac{8x + 2}{5}$, so $m = \frac{8}{5}$, $c = \frac{2}{5}$.

f. $y = \frac{x + 3}{2}$, so $m = \frac{1}{2}$, $c = \frac{3}{2}$.

2. The formula is $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$. You should check that the points actually satisfy the equation!

a. $\frac{y - 3}{x - 3} = \frac{5 - 3}{1 - 3} = -1$, so $y - 3 = -(x - 3) = -x + 3$, or $x + y = 6$.

b. $\frac{y - 2}{x + 1} = \frac{6 - 2}{0 + 1} = 4$, so $y - 2 = 4(x + 1)$, or $y = 4x + 6$.

c. Here the gradient is $\frac{4 + 1}{4 - 4} = \infty$, so something is wrong. But drawing the line, we see that the correct equation is $x = 4$.

d. $\frac{y - 7}{x - 1} = \frac{9 - 7}{2 - 1} = 2$, so $y - 7 = 2(x - 1)$, or $y = 2x + 5$.

e. You might spot directly that this is $y = 1$. Going through the routine above gives $(y - 1)/(x - 3) = (1 - 1)/(7 - 3)$, or $y - 1 = 0$, so $y = 1$.

3. Use the formula $y - y_1 = m(x - x_1)$.

a. $y - 4 = 3(x - 1)$, so $y = 3x + 1$.

b. $y - (-1) = \frac{1}{3}(x - 6)$, which becomes $y = -\frac{1}{3}x + 1$, or $3y + x = 3$.

c. $y - 2 = 7(x - (-1))$, or $y = 7x + 9$.

d. $y - 2 = \frac{1}{4}(x - 0)$, or $y = \frac{1}{4}x + 2$.

e. $(y - 0) = 10(x - 0)$, or $y = 10x$.

4. Two lines with gradients $m$ and $m'$ are perpendicular if $mm' = -1$.

a. $4m' = -1$ so $m' = -\frac{1}{4}$. We do the same calculation for the others.

b. $-1$. c. $\frac{1}{3}$.

d. $\frac{9}{7}$. e. $-\frac{5}{8}$. f. $-2$.

5. The gradient is $(7 - 3)/(3 - 1)$, or 2, so the line is $(y - 0) = 2(x - 1)$, or $y = 2x - 2$.

6. The midpoint is $(\frac{1+3}{2}, \frac{1+5}{2})$, or $(2, 3)$. The gradient of the original line is $(5 - 1)/(3 - 1)$ or 2, so the perpendicular line has gradient $-\frac{1}{2}$, and is thus $y - 3 = -\frac{1}{2}(x - 2)$, or $y = -\frac{1}{2}x + 4$, which looks nicer written as $x + 2y = 8$. 