Straight line graphs 5H

1 a i Gradient $= \dfrac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{600 - 200}{12 - 4}$$

$$= \frac{400}{8}$$

$$= 50$$

$$k = 50$$

Direct proportion equations go through the origin so $c = 0$.

ii $d = kt + c \quad k = 50,\ c = 0$

$d = 50t$

b i Gradient $= \dfrac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{9 - 3}{30 - 10}$$

$$= \frac{6}{20}$$

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

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

ii $C = kt + c \quad k = \frac{3}{10},\ c = 0$

$C = \frac{3}{10}t$

c i Gradient $= \dfrac{y_2 - y_1}{x_2 - x_1}$

$$= \frac{18 - 6}{30 - 10}$$

$$= \frac{12}{20}$$

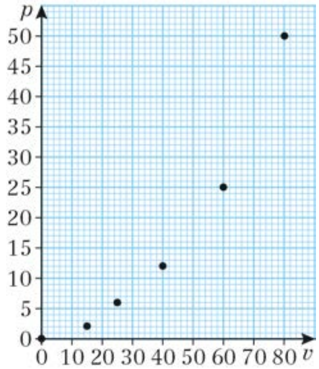
$$= \frac{3}{5}$$

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

ii $p = kt + c \quad k = \frac{3}{5},\ c = 0$

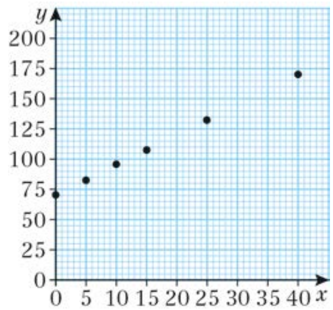
$p = \frac{3}{5}t$

2 a



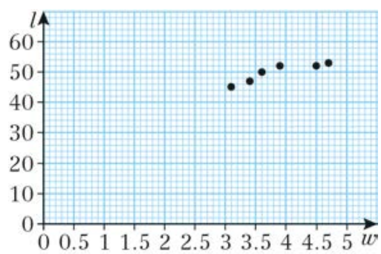
The points do not lie on a straight line, so a linear model is not appropriate.

b



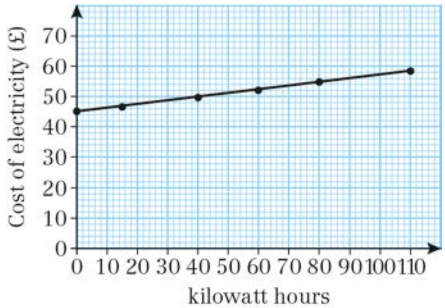
The points lie on a straight line so a linear model is appropriate.

c



The points do not lie on a straight line, so a linear model is not appropriate.

3 a



b The points lie on a straight line so a linear model is appropriate.

c $\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{58.2 - 45}{110 - 0}$

$= \frac{13.2}{110}$

$= 0.12$

$E = ah + b$

a is the gradient = 0.12

b is the y-intercept = 45

$E = 0.12h + 45$

d a = £0.12, this is the cost of 1 kilowatt hour of electricity.

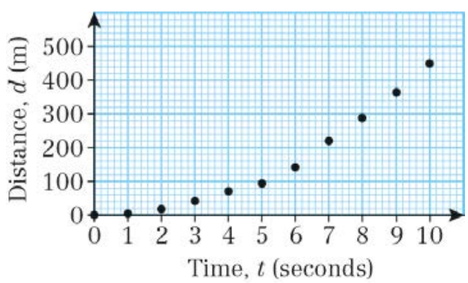
b = £45, this is the fixed charge for the electricity supply (per month or per quarter).

e When $h = 65$:

$E = 0.12(65) + 45$

= £52.80

4 a



b The points do not lie on a straight line, so a linear model is not appropriate.

5 a $(x_1, y_1) = (6, 7100)$

$(x_2, y_2) = (13, 9550)$

$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{9550 - 7100}{13 - 6}$

$= \frac{2450}{7}$

$= 350$

$C = ad + b$

$C = 350d + b$

Substituting $d = 6$ and $C = 7100$ into $C = 350d + b$ gives:

$7100 = 350(6) + b$

$b = 5000$

$C = 350d + 5000$

b a = £350, this is the daily fee charged by the web designer.

b = £5000, this is the flat rate fee charged by the web designer.

c Substitute $C = 13\,400$ into $C = 350d + 5000$ to give:

$13\,400 = 350d + 5000$

$d = 24$

The designer spent 24 days working on the website.

6 a $(x_1, y_1) = (9, 48.2)$, $(x_2, y_2) = (20, 68)$

$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{68 - 48.2}{20 - 9}$

$= \frac{19.8}{11}$

$= 1.8$

$F = 1.8C + b$

Substituting $C = 9$ and $F = 48.2$ into $F = 1.8C + b$ gives:

$48.2 = 1.8(9) + b$

$b = 32$

$F = 1.8C + 32$

6 b $a = 1.8$ which is the increase in the Fahrenheit temperature for every 1 degree increase in the Celsius temperature.
$b = 32$ which is the Fahrenheit temperature when the Celsius temperature is zero.

c Substitute $F = 101.3$ into $F = 1.8C + 32$ to give:
$101.3 = 1.8C + 32$
$C = 38.5$
The temperature 101.3 °F is 38.5 °C.

d $F = 1.8C + 32$
When $F = C$:
$F = 1.8F + 32$
$-0.8F = 32$
$F = -40$
−40 °F is the same as −40 °C.

7 a Gradient = 750
Intercept on the vertical axis = 17 500
$n = 750t + 17\,500$

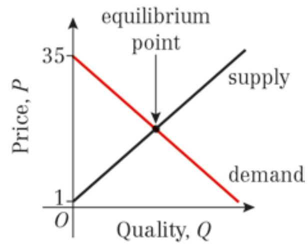
b The assumption is that the number of homes receiving internet connection will increase by the same amount each year.

8 a The data can be approximated to a linear model as all of the points lie close to the line of best fit shown.

b Gradient $= \dfrac{y_2 - y_1}{x_2 - x_1}$
$= \dfrac{177 - 165}{27 - 24}$
$= 4$
$h = 4f + b$
Substituting $f = 24$ and $h = 165$ into $h = 4f + b$ gives:
$165 = 4(24) + b$
$b = 69$
$h = 4f + 69$

8 c Substituting $f = 26.5$ into $h = 4f + 69$ gives:
$h = 4(26.5) + 69$
$= 175$ cm

9 a



b Solve $P = -\frac{3}{4}Q + 35$ and $P = \frac{2}{3}Q + 1$ simultaneously:
$-\frac{3}{4}Q + 35 = \frac{2}{3}Q + 1$
$34 = \frac{17}{12}Q$
$Q = 24$
Substituting $Q = 24$ into P gives:
$P = \frac{2}{3}Q + 1$: P
$= \frac{2}{3}(24) + 1$
$= 17$
$P = 17$, $Q = 24$

