8 $\frac{^-25}{2}$

9 **a** $a \geq 5$ **b** $x > ^-9$
c $g < ^-6$ **d** $d \geq 1$
e $x < 6$

10 **a** $P_F = 2x + 18m$ **b** $A_{path} = 3x + 16m^2$
c $l = 8m$, $w = 2m$ **d** $\frac{8}{25}$

11 **a** $P_1 = 10x + 12$ cm **b** $x = 2$ cm
$P_2 = 16x$ cm

12 **a** Answers will vary. **b** $x < 16$
c $15.75 \times 15.75 \times 29.5$ cm **d** Answers will vary

13 **a** $A = \pi R^2 - x^2$ **b** $A = 160.71$ cm^2
c Answers will vary. **d** $R = 5.32$ cm
e 92%

14 **a** $C = 40h + 250$ **b** 18 hours, 45 minutes
c 18 750
d The printing is cheaper by $1375.

15 **a** \$3007.31 **b** \$4969.69
c 1.87% **d** 10 years

EXERCISE 3A

1 **a** A linear relationship means that as one variable changes uniformly, so does the other.

b Linear relationships can be identified by using a table of values, plotting points or looking at an equation.

2 **a** As the x-values increase by 1, the y-values decrease by 4. Since x is changing by a constant amount and y is changing by a constant amount, the table of values represents a linear relationship.

b As the x-values increase by 5, the y-values increase and then decrease. Since y is neither increasing nor decreasing, the relationship is not linear.

c As the x-values increase by 2, the y-values increase by 1. Since x is changing by a constant amount and y is changing by a constant amount, the table of values represents a linear relationship.

d As the x-values increase by 1, the y-values are multiplying exponentially. Since y is not changing by a constant amount, the relationship is not linear.

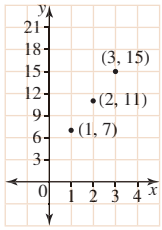
e As the x-values increase by 2, the y-values decrease by 3. Since x is changing by a constant amount and y is changing by a constant amount, the table of values represents a linear relationship.

f As the x-values increase by 10, the y-values remain the same. Since x is changing by a constant amount and y does not change, the graph will be a straight line and thus the table of values represents a linear relationship.

3 **a** **i** Linear

ii

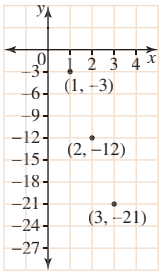
x	1	2	3
y	7	11	15



b **i** Linear

ii

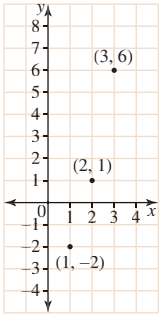
x	1	2	3
y	$^-3$	$^-12$	$^-21$



c **i** Not linear

ii

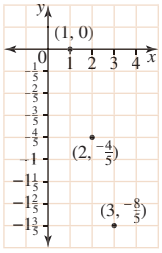
x	1	2	3
y	$^-2$	1	6



d **i** Linear

ii

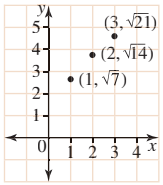
x	1	2	3
y	0	$\frac{^-4}{5}$	$\frac{^-8}{5}$



e **i** Not linear

ii

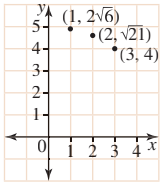
x	1	2	3
y	$\sqrt{7}$	$\sqrt{14}$	$\sqrt{21}$



f i Not linear

ii

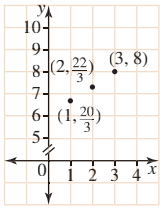
x	1	2	3
y	$2\sqrt{6}$	$\sqrt{21}$	4



g i Linear

ii

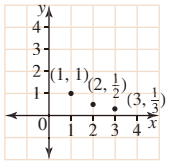
x	1	2	3
y	$\frac{20}{3}$	$\frac{22}{3}$	8



h i Not linear

ii

x	1	2	3
y	1	$\frac{1}{2}$	$\frac{1}{3}$



4 a Linear **b** Not linear **c** Not linear
d Not linear **e** Not linear **f** Linear

5 a

x	1	2	3	4	5
y	9	13	17	21	25

b

x	1	2	3	4	5
y	1	6	11	16	21

c

x	1	2	3	4	5
y	$^{-}4$	$^{-}8$	$^{-}12$	$^{-}16$	$^{-}20$

d

x	1	2	3	4	5
y	$^{-}7$	$^{-}9$	$^{-}11$	$^{-}13$	$^{-}15$

e

x	1	2	3	4	5
y	9	10	11	12	13

f

x	1	2	3	4	5
y	8	7	6	5	4

6 A

7 a

Day (d)	Distance (D)
Monday (1)	1 km
Tuesday (2)	1.25 km
Wednesday (3)	1.5 km
Thursday (4)	1.75 km
Friday (5)	2 km
Saturday (6)	2.25 km
Sunday (7)	2.5 km

b Linear **c** 0.25 km per day **d** 3.25 km

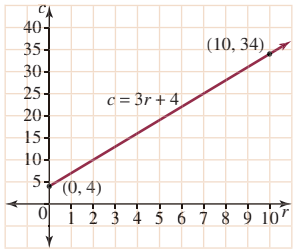
8 a i \$4 **ii** \$7 **iii** \$10

b

r	0	1	2	3	4	5
c	4	7	10	13	16	19

c B

d



e The graph is a positive straight line with a y-intercept at (0, 4) and a gradient of 3. The initial cost to enter the amusement park is \$4 and there is then an additional cost of \$3 per ride.

9 a i 12 minutes **ii** 24 minutes **iii** 82 minutes

b

q	0	1	2	3	4	5	6	7	8	9	10
t	0	12	14	36	48	60	82	94	106	118	130
q	11	12	13	14	15	16	17	18	19	20	
t	152	164	176	188	200	222	234	246	258	270	

c Not linear

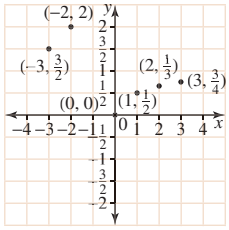
10 22 February of the following year

Going further

1

x	$^{-}3$	$^{-}2$	$^{-}1$	0	1	2	3
y	$\frac{3}{2}$	2	Undefined	0	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$

2



3 Not linear

Extension

1 Yes, it would appear to be linear.

2 No, it is not linear.

3 To be absolutely certain that a relationship is linear, you need more than just a table of values.

EXERCISE 3B

1 The general shape formed from a linear equation is a straight line.

2 A

3 **a** (0, $^{-}2$) **b** (0, 1) **c** (0, 0)

4 **a** Positive **b** Positive
c Negative **d** Zero

5 **a** $m = \frac{1}{2}$ **b** $m = \frac{^{-}3}{2}$

6 **a** $m = 4$ **b** $m = ^{-}3$

7

	Rise	Run	Gradient
a	10 metres	4 metres	$\frac{5}{2}$
b	10 metres	2 metres	5
c	5 metres	10 metres	$\frac{1}{2}$

8 **a** **i** C **ii** B **iii** A
b Straight line y-intercept of (0, 2) with a slope of $\frac{^{-}1}{4}$.

9 **a** **i** (0, 1) **ii** (0, 12)
b **i** Straight line with a slope of $^{-}3$
ii Straight line with a slope of $^{-}2$

10 **a** $m = \frac{^{-}3}{2}$
b It does not matter which points are chosen to determine the gradient of the graph because the gradient will always remain the same.
c Straight line with a y-intercept of (0, $^{-}2$) and a slope of $\frac{^{-}3}{2}$

Going further

1 Red

2 $m = 2$, $m = 1$

3 The red graph has the greatest slope, which means for every increase in x, there are two increases in y.

Extension

1 Answers will vary.

2 Answers will vary.

3 Answers will vary.

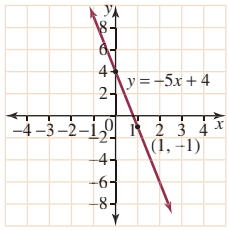
4 By moving the first point closer to the second point

EXERCISE 3C

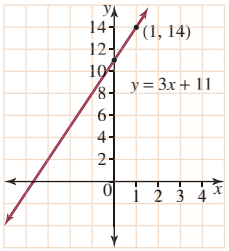
1 **a** $y = mx + c$
b m is the gradient of the graph and c is the y-intercept.

2 **a** $m = ^{-}5$, $c = 4$ **b** $m = 3$, $c = 11$ **c** $m = ^{-}6$, $c = 0$
d $m = \frac{5}{2}$, $c = 5$ **e** $m = \frac{2}{3}$, $c = ^{-}6$ **f** $m = 2$, $c = ^{-}1$

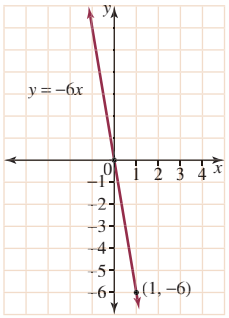
3 **a**



b



c



d