6 You should have found that the equation of the parabolic boundary of the tunnel is $y = -0.8889x^2 + 8$ and the equation of the truck's roofline is $y = 4.8$.

Graph these equations on the same set of axes. Calculate the **points of intersection** of the graphs of these functions.

7 Using the points of intersection found in **6**, will the truck pass through the tunnel? What is the maximum width of a truck that is 4.8 m high if it is to pass through the tunnel?

8 Investigate the maximum width of a truck that is 3.7 m high if it is to pass through the tunnel.

9 What is the maximum width of a 4.1 m high truck if it is to pass through a parabolic tunnel 6.5 m high and 5 m wide?

REVIEW SET 8A

1 For $y = -2(x+2)(x-1)$:

a state the x-intercepts
b state the equation of the axis of symmetry
c find the coordinates of the vertex
d find the y-intercept
e sketch the graph of the function
f use technology to check your answers.

2 For $y = \frac{1}{2}(x-2)^2 - 4$:

a state the equation of the axis of symmetry
b find the coordinates of the vertex
c find the y-intercept
d sketch the graph of the function
e use technology to check your answers.

3 For $y = x^2 - 4x - 1$:

a convert into the form $y = (x-h)^2 + k$ by 'completing the square'
b state the coordinates of the vertex
c find the y-intercept.
d Hence sketch the graph of the quadratic.
e Use technology to check your answer.

4 For $y = 2x^2 + 6x - 3$:

a convert into the form $y = a(x-h)^2 + k$ by 'completing the square'
b state the coordinates of the vertex
c find the y-intercept.
d Hence sketch the graph of the quadratic.
e Use technology to check your answer.

5 Solve the following equations:

a $x^2 - 11x = 60$ **b** $3x^2 - x - 10 = 0$ **c** $3x^2 - 12x = 0$

6 Solve the following equations:

a $x^2 + 10 = 7x$ **b** $x + \dfrac{12}{x} = 7$ **c** $2x^2 - 7x + 3 = 0$

7 Solve the following equation by completing the square: $x^2 + 7x - 4 = 0$

8 Solve the following equation by completing the square: $x^2 + 4x + 1 = 0$

9 Solve the following using the quadratic formula:

a $x^2 - 7x + 3 = 0$ **b** $2x^2 - 5x + 4 = 0$

REVIEW SET 8B

1 Draw the graph of $y = -x^2 + 2x$.

2 Determine the equation of the axis of symmetry and the vertex of the quadratic relation $y = -3x^2 + 8x + 7$.

3 Determine the equation of the axis of symmetry and the vertex of the quadratic relation $y = 2x^2 + 4x - 3$.

4 Use the discriminant only to determine the number of solutions to:

a $3x^2 - 5x + 7 = 0$ **b** $-2x^2 - 4x + 3 = 0$

5 Show that $5 + 7x + 3x^2$ is positive definite.

6 Find the maximum or minimum value of the relation $y = -2x^2 + 4x + 3$ and the value of x for which the maximum or minimum occurs.

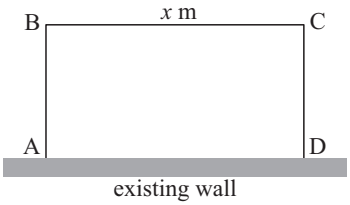
7 Find the points of intersection of $y = x^2 - 3x$ and $y = 3x^2 - 5x - 24$.

8 For what values of k does the graph of $y = -2x^2 + 5x + k$ not cut the x-axis?

9 60 m of chicken wire is available for constructing a chicken enclosure against an existing wall. The enclosure is to be rectangular.

a If BC $= x$ m, show that the area of rectangle ABCD is given by $A = (30x - \frac{1}{2}x^2)$ m^2.

b Find the dimensions of the enclosure which will maximise the area enclosed.



REVIEW SET 8C

1 Solve the following using the quadratic formula:

a $x^2 + 5x + 3 = 0$ **b** $3x^2 + 11x - 2 = 0$

2 Solve the following equations:

a $x^2 - 5x - 3 = 0$ **b** $2x^2 - 7x - 3 = 0$

3 Use technology to solve:

a $x^2 + 6x + 1 = 0$ **b** $3x^2 - x - 5 = 0$

4 Use technology to solve:

a $(x - 2)(x + 1) = 3x - 4$ **b** $2x - \dfrac{1}{x} = 5$

5 Using the discriminant only, determine the nature of the solutions of:

a $2x^2 - 5x - 7 = 0$ **b** $3x^2 - 24x + 48 = 0$

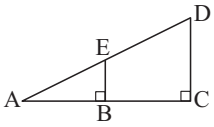
6 Find the values of m for which $2x^2 - 3x + m = 0$ has:

a a repeated root **b** two distinct real roots **c** no real roots

7 Find the value of t for which the quadratic $3x^2 + 4x + t = 0$ has:

a a repeated root **b** two distinct real roots **c** no real roots

8 If AB is the same length as CD, BC is 2 cm shorter than AB and BE is 7 cm in length, find the length of AB.



9 Find the length of the hypotenuse of a right angled triangle with one leg 7 cm longer than the other and the hypotenuse 2 cm longer than the longer leg.

REVIEW SET 8D

1 Use axis intercepts only to sketch the graph of $y = 3x(x - 2)$.

2 Use the vertex, axis of symmetry and y-intercept to graph:

a $y = (x - 2)^2 - 4$ **b** $y = -\frac{1}{2}(x + 4)^2 + 6$

3 For the quadratic $y = 2x^2 + 4x - 1$, find:

a the equation of the axis of symmetry

b the coordinates of the vertex

c the axis intercepts.

d Hence sketch the graph of the quadratic.

4 Use the discriminant only to find the relationship between the graph and the x-axis for:

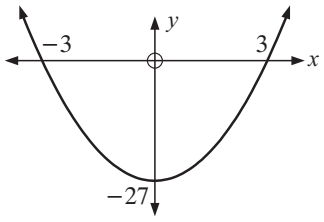
a $y = 2x^2 + 3x - 7$ **b** $y = -3x^2 - 7x + 4$

5 Determine if the quadratic functions are positive definite, negative definite or neither:

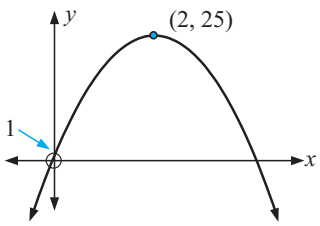
a $y = -2x^2 + 3x + 2$ **b** $y = 3x^2 + x + 11$

6 Find the equation of the quadratic relation with graph:

a



b



7 The sum of a number and its reciprocal is $2\frac{1}{30}$. Find the number.

8 An open square container is made by cutting 4 cm square pieces out of a piece of tinplate. If the capacity is 120 cm^3, find the size of the original piece of tinplate.

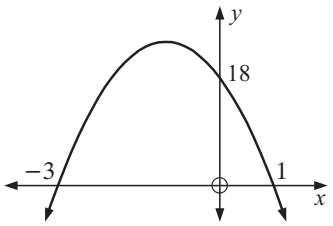
9 Find the point of intersection of the graphs with equations

$y = -x^2 - 5x + 3$ and $y = x^2 + 3x + 11$.

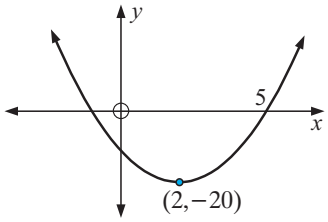
REVIEW SET 8E

1 Find the equation of the quadratic relation with graph:

a

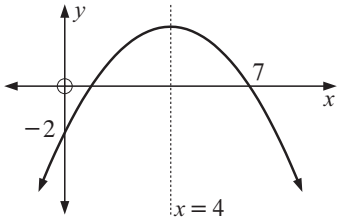


b

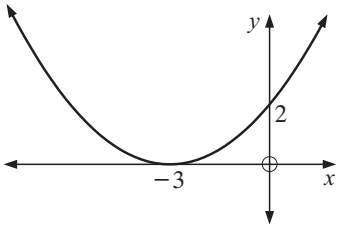


2 Find the equation of the quadratic with graph:

a



b



3 Find an expression for a quadratic which cuts the x-axis at 3 and -2 and has y-intercept 24. Give your answer in the form $y = ax^2 + bx + c$.

4 Find in the form $y = ax^2 + bx + c$, the equation of the quadratic whose graph touches the x-axis at 4 and passes through (2, 12).

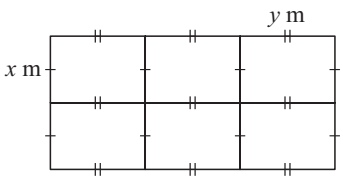
5 Find, in the form $y = ax^2 + bx + c$, the equation of the quadratic whose graph has vertex $(-4, 1)$ and passes through $(1, 11)$.

6 Find the maximum or minimum value of the following quadratics, and the corresponding values of x:

a $y = 3x^2 + 4x + 7$ **b** $y = -2x^2 - 5x + 2$

7 For what values of k would the graph of $y = x^2 - 2x + k$ cut the x-axis twice? Check your answer(s) using technology.

8 600 m of fencing are used to construct 6 rectangular animal pens as shown.



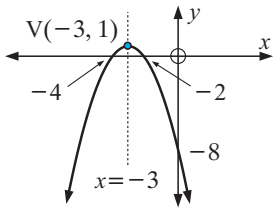
a Show that $y = \dfrac{600 - 8x}{9}$.

b Find the area A, of each pen, in terms of x.

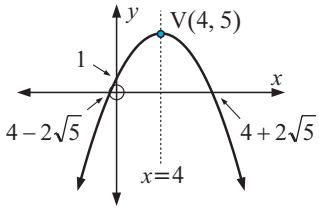
c Find the dimensions of each pen when each pen has a maximum area.

d What is the maximum area of each pen?

h **i** $x = -3$ **iv**
ii $(-3, 1)$
iii x-int. -2, -4, y-intercept -8



i **i** $x = 4$ **iv**
ii $(4, 5)$
iii x-int. $4 \pm 2\sqrt{5}$, y-intercept 1



EXERCISE 8I.1

1 **a** 2 real distinct roots **b** a repeated root
c 2 real distinct roots **d** 2 real distinct roots
e no real roots **f** a repeated root

2 **a**, **b**, **d**, **f**

3 **a** $\Delta = 9 - 4m$ **i** $m = \frac{9}{4}$ **ii** $m < \frac{9}{4}$ **iii** $m > \frac{9}{4}$
b $\Delta = 25 - 4m$ **i** $m = \frac{25}{4}$ **ii** $m < \frac{25}{4}$ **iii** $m > \frac{25}{4}$
c $\Delta = 1 - 4m$ **i** $m = \frac{1}{4}$ **ii** $m < \frac{1}{4}$ **iii** $m > \frac{1}{4}$
d $\Delta = 4 - 12m$ **i** $m = \frac{1}{3}$ **ii** $m < \frac{1}{3}$ **iii** $m > \frac{1}{3}$
e $\Delta = 49 - 8m$ **i** $m = \frac{49}{8}$ **ii** $m < \frac{49}{8}$ **iii** $m > \frac{49}{8}$
f $\Delta = 25 - 16m$ **i** $m = \frac{25}{16}$ **ii** $m < \frac{25}{16}$ **iii** $m > \frac{25}{16}$

EXERCISE 8I.2

1 **a** cuts x-axis twice **b** touches x-axis
c cuts x-axis twice **d** cuts x-axis twice
e cuts x-axis twice **f** touches x-axis

2 **a** $a = 1$ which is > 0 and $\Delta = -15$ which is < 0
b $a = -1$ which is < 0 and $\Delta = -8$ which is < 0
c $a = 2$ which is > 0 and $\Delta = -40$ which is < 0
d $a = -2$ which is < 0 and $\Delta = -23$ which is < 0

3 $a = 3$ which is > 0 and $\Delta = k^2 + 12$ which is always > 0 {as $k^2 > 0$ for all k}

4 $a = 2$ which is > 0 and $\Delta = k^2 - 16$ $\therefore$ positive definite when $k^2 - 16 < 0$ i.e., $k^2 < 16$ i.e., $-4 < k < 4$

EXERCISE 8J

1 **a** $y = 2(x - 1)(x - 2)$ **b** $y = 2(x - 2)^2$
c $y = (x - 1)(x - 3)$ **d** $y = -(x - 3)(x + 1)$
e $y = -3(x - 1)^2$ **f** $y = -2(x + 2)(x - 3)$

2 **a** C **b** E **c** B **d** F **e** G **f** H **g** A **h** D

3 **a** $y = \frac{3}{2}(x - 2)(x - 4)$ **b** $y = -\frac{1}{2}(x + 4)(x - 2)$
c $y = -\frac{4}{3}(x + 3)^2$

4 **a** $y = 3x^2 - 18x + 15$ **b** $y = -4x^2 + 6x + 4$
c $y = -x^2 + 6x - 9$ **d** $y = 4x^2 + 16x + 16$
e $y = \frac{3}{2}x^2 - 6x + \frac{9}{2}$ **f** $y = -\frac{1}{3}x^2 + \frac{2}{3}x + 5$

5 **a** $y = -(x - 2)^2 + 4$ **b** $y = 2(x - 2)^2 - 1$
c $y = -2(x - 3)^2 + 8$ **d** $y = \frac{2}{3}(x - 4)^2 - 6$
e $y = -2(x - 2)^2 + 3$ **f** $y = 2(x - \frac{1}{2})^2 - \frac{3}{2}$

EXERCISE 8K

1 **a** (1, 7) and (2, 8) **b** (4, 5) and $(-3, -9)$
c (3, 0) (touching) **d** graphs do not meet

2 **a** (0.59, 5.59) and (3.41, 8.41)
b (3, -4) touching **c** graphs do not meet
d $(-2.56, -18.81)$ and (1.56, 1.81)

3 **a** (2, 4), $(-1, 1)$ **b** (1, 0), $(-2, -3)$ **c** (1, 4)
d (1, 4), $(-4, -1)$

EXERCISE 8L

1 **a** 9 seconds **b** 162 m **c** 18 seconds

2 **a** 12 **b** \$100 **c** \$244

3 **a** 15 m/s **b** $\frac{1}{2}$ sec; since the car was travelling downhill, it was accelerating. $\therefore$ when the brake was applied, the speed of the vehicle still increased for a short time.
c $15\frac{1}{8}$ m/s **d** 6 seconds

4 **a** 21 **b** \$837 **c** \$45 **5** **a** 30°C **b** 5.00 am **c** 5°C

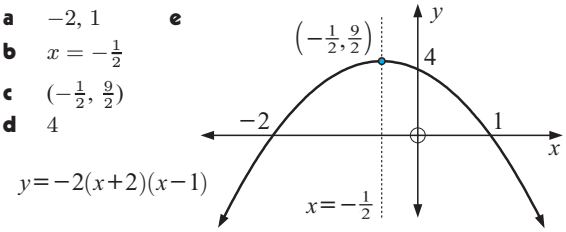
6 **b** $x = 10$ **c** 200 m^2

7 **a** $y = -\frac{1}{100}x^2 + 70$ **b** supports are 21 m, 34 m, 45 m, 54 m, 61 m, 66 m, 69 m

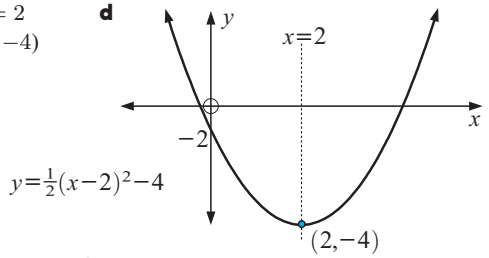
8 **a** vertex (30, 30) **b** $y = \frac{1}{45}(x - 30)^2 + 30$ **c** 38.89 m

REVIEW SET 8A

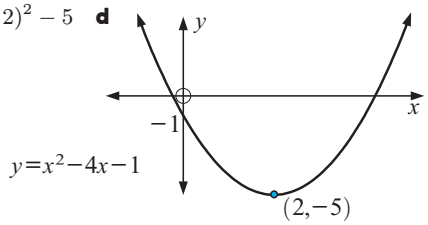
1 **a** -2, 1
b $x = -\frac{1}{2}$
c $(-\frac{1}{2}, \frac{9}{2})$
d 4
e



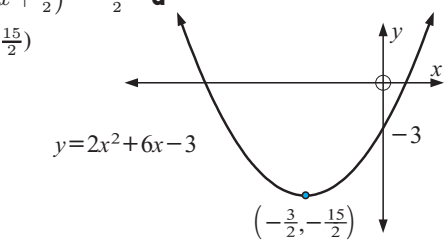
2 **a** $x = 2$
b $(2, -4)$
c -2
d



3 **a** $y = (x - 2)^2 - 5$
b $(2, -5)$
c -1
d



4 **a** $y = 2\left(x + \frac{3}{2}\right)^2 - \frac{15}{2}$
b $(-\frac{3}{2}, -\frac{15}{2})$
c -3
d



5 **a** $x = 15$ or -4 **b** $x = -\frac{5}{3}$ or 2 **c** $x = 0$ or 4

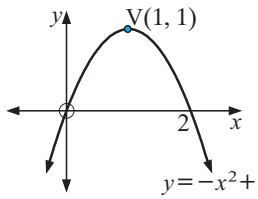
6 **a** $x = 5$ or 2 **b** $x = 3$ or 4 **c** $x = \frac{1}{2}$ or 3

7 $x = -\frac{7}{2} \pm \frac{\sqrt{65}}{2}$ **8** $x = -2 \pm \sqrt{3}$

9 **a** $x = \frac{7}{2} \pm \frac{\sqrt{37}}{2}$ **b** no real roots

REVIEW SET 8B

1



2 $x = \frac{4}{3}$, V$(\frac{4}{3}, 12\frac{1}{3})$

3 $x = -1$, V$(-1, -5)$

4 **a** no real solutions **b** two real distinct solutions

5 $a = 3$ which is > 0 and $\Delta = -11$ which is < 0

6 $a = -2$ which is < 0 $\therefore$  a max.
max. $= 5$ when $x = 1$

7 $(4, 4)$ and $(-3, 18)$ **8** $k < -3\frac{1}{8}$ **9** **b** 15 m by 30 m

REVIEW SET 8C

1 **a** $x = -\frac{5}{2} \pm \frac{\sqrt{13}}{2}$ **b** $x = \frac{-11 \pm \sqrt{145}}{6}$

2 **a** $x = \frac{5}{2} \pm \frac{\sqrt{37}}{2}$ **b** $x = \frac{7}{4} \pm \frac{\sqrt{73}}{4}$

3 **a** $x = -5.828$ or -0.1716 **b** $x = -1.135$ or 1.468

4 **a** $x = 0.5858$ or 3.414 **b** $x = -0.1861$ or 2.686

5 **a** two distinct real rational roots **b** a repeated root

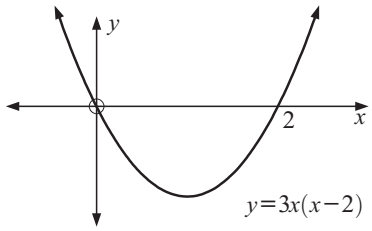
6 **a** $m = \frac{9}{8}$ **b** $m < \frac{9}{8}$ **c** $m > \frac{9}{8}$

7 **a** $t = \frac{4}{3}$ **b** $t < \frac{4}{3}$ **c** $t > \frac{4}{3}$

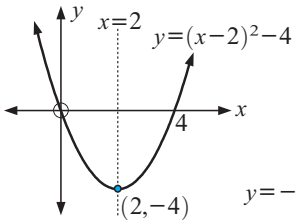
8 12.92 cm **9** 17 cm

REVIEW SET 8D

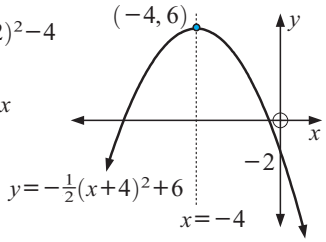
1



2 **a**

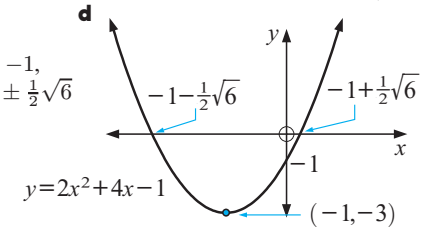


b

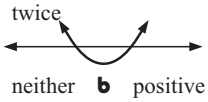


3 **a** $x = -1$ **b** $(-1, -3)$ **c** y-intercept -1, x-ints. $-1 \pm \frac{1}{2}\sqrt{6}$

d



4 **a** graph cuts x-axis twice



b graph cuts x-axis twice

5 **a** neither **b** positive definite

6 **a** $y = 3(x - 3)(x + 3)$ **b** $y = -6(x - 2)^2 + 25$

7 $\frac{6}{5}$ or $\frac{5}{6}$ **8** 13.48 cm by 13.48 cm **9** touch at $(-2, 9)$

REVIEW SET 8E

1 **a** $y = -6(x + 3)(x - 1)$ **b** $y = \frac{20}{9}(x - 2)^2 - 20$

2 **a** $y = -\frac{2}{7}(x - 1)(x - 7)$ **b** $y = \frac{2}{9}(x + 3)^2$

3 $y = -4x^2 + 4x + 24$ **4** $y = 3x^2 - 24x + 48$

5 $y = \frac{2}{5}x^2 + \frac{16}{5}x + \frac{37}{5}$

6 **a** min. $= 5\frac{2}{3}$ when $x = -\frac{2}{3}$ **b** max. $= 5\frac{1}{8}$ when $x = -\frac{5}{4}$

7 $k < 1$

8 **b** $A = x\left(\frac{600 - 8x}{9}\right)$ **c** $37\frac{1}{2}$ m by $33\frac{1}{3}$ m **d** 1250 m^2

9 **b** $x = 6$

EXERCISE 9A

1 **a** $x^3 + 3x^2 + 3x + 1$ **b** $x^3 + 6x^2 + 12x + 8$
c $x^3 - 12x^2 + 48x - 64$ **d** $8x^3 + 12x^2 + 6x + 1$
e $8x^3 - 12x^2 + 6x - 1$ **f** $27x^3 - 27x^2 + 9x - 1$
g $8x^3 + 60x^2 + 150x + 125$ **h** $8x^3 + 12x + \frac{6}{x} + \frac{1}{x^3}$

2 **a** $x^4 + 8x^3 + 24x^2 + 32x + 16$ **b** $x^4 - 8x^3 + 24x^2 - 32x + 16$
c $16x^4 + 96x^3 + 216x^2 + 216x + 81$
d $81x^4 - 108x^3 + 54x^2 - 12x + 1$
e $x^4 + 4x^2 + 6 + \frac{4}{x^2} + \frac{1}{x^4}$ **f** $16x^4 - 32x^2 + 24 - \frac{8}{x^2} + \frac{1}{x^4}$

3 **a** $x^5 + 10x^4 + 40x^3 + 80x^2 + 80x + 32$
b $x^5 - 10x^4 + 40x^3 - 80x^2 + 80x - 32$
c $32x^5 + 80x^4 + 80x^3 + 40x^2 + 10x + 1$
d $32x^5 - 80x^3 + 80x - \frac{40}{x} + \frac{10}{x^3} - \frac{1}{x^5}$

4 **a** 1 6 15 20 15 6 1
b **i** $x^6 + 12x^5 + 60x^4 + 160x^3 + 240x^2 + 192x + 64$
ii $64x^6 - 192x^5 + 240x^4 - 160x^3 + 60x^2 - 12x + 1$
iii $x^6 + 6x^4 + 15x^2 + 20 + \frac{15}{x^2} + \frac{6}{x^4} + \frac{1}{x^6}$

5 **a** $7 + 5\sqrt{2}$ **b** $56 + 24\sqrt{5}$ **c** $232 - 164\sqrt{2}$

6 **a** $64 + 192x + 240x^2 + 160x^3 + 60x^4 + 12x^5 + x^6$
b 65.944 160 601 201

7 $2x^5 + 11x^4 + 24x^3 + 26x^2 + 14x + 3$ **8** **a** 270 **b** 4320

EXERCISE 9B

1 **a** $1^{11} + \binom{11}{1}(2x) + \binom{11}{2}(2x)^2 + ... + \binom{11}{10}(2x)^{10} + (2x)^{11}$

b $(3x)^{15} + \binom{15}{1}(3x)^{14}\left(\frac{2}{x}\right) + \binom{15}{2}(3x)^{13}\left(\frac{2}{x}\right)^2 + ...$
$.... + \binom{15}{14}(3x)\left(\frac{2}{x}\right)^{14} + \left(\frac{2}{x}\right)^{15}$

c $(2x)^{20} + \binom{20}{1}(2x)^{19}\left(-\frac{3}{x}\right) + \binom{20}{2}(2x)^{18}\left(-\frac{3}{x}\right)^2 + ...$
$.... + \binom{20}{19}(2x)\left(-\frac{3}{x}\right)^{19} + \left(-\frac{3}{x}\right)^{20}$

2 **a** $T_6 = \binom{15}{5}(2x)^{10}5^5$ **b** $T_4 = \binom{9}{3}(x^2)^6\left(\frac{5}{x}\right)^3$

c $T_{10} = \binom{17}{9}x^8\left(-\frac{2}{x}\right)^9$ **d** $T_9 = \binom{21}{8}(2x^2)^{13}\left(-\frac{1}{x}\right)^8$

3 **a** $\binom{10}{5}3^5 2^5$ **b** $\binom{6}{3}2^3(-3)^3$ **c** $\binom{12}{4}2^8(-1)^4$

4 **a** $\binom{15}{5}2^5$ **b** $\binom{9}{3}(-3)^3$