

Questions – Summer holiday work

Expanding brackets and simplifying expressions

1 Expand and simplify.

a $7(3x + 5) + 6(2x - 8)$

b $9(3s + 1) - 5(6s - 10)$

c $4p(2p - 1) - 3p(5p - 2)$

d $3b(4b - 3) - b(6b - 9)$

e $(2x + 3)(x - 1)$

f $(5x - 3)(2x - 5)$

g $(x + 5)^2$

Surds and rationalising the denominator

2 Expand and simplify.

a $(\sqrt{2} + \sqrt{3})(\sqrt{2} - \sqrt{3})$

b $(4 - \sqrt{5})(\sqrt{45} + 2)$

3 Rationalise and simplify.

a $\frac{1}{3 - \sqrt{5}}$

b $\frac{2}{4 + \sqrt{3}}$

c $\frac{6}{5 - \sqrt{2}}$

Rules of indices

4 Simplify.

a $\frac{3x^2 \times x^3}{2x^2}$

b $\frac{7x^3 y^2}{14x^5 y}$

c $\frac{y^2}{y^{\frac{1}{2}} \times y}$

d $\frac{c^{\frac{1}{2}}}{c^2 \times c^{\frac{3}{2}}}$

e $\frac{(2x^2)^3}{4x^0}$

f $\frac{x^{\frac{1}{2}} \times x^{\frac{3}{2}}}{x^{-2} \times x^3}$

5 Write the following as a single power of x .

a $\frac{1}{x}$

b $\frac{1}{x^7}$

c $\sqrt[4]{x}$

d $\sqrt[5]{x^2}$

e $\frac{1}{\sqrt[3]{x}}$

f $\frac{1}{\sqrt[3]{x^2}}$

6 Write the following without negative or fractional powers.

a x^0

b $x^{\frac{2}{5}}$

c $x^{-\frac{1}{2}}$

d $x^{-\frac{3}{4}}$

7 Write the following in the form ax^n .

a $5\sqrt{x}$

b $\frac{2}{x^3}$

c $\frac{1}{3x^4}$

d 3

Factorising expressions

8 Factorise.

a $6x^4y^3 - 10x^3y^4$

c $25x^2y^2 - 10x^3y^2 + 15x^2y^3$

e $x^2 + 5x - 14$

g $x^2 - 5x - 24$

i $x^2 + 3x - 28$

k $4x^2 - 81y^2$

m $2x^2 + x - 3$

o $10x^2 + 21x + 9$

b $21a^3b^5 + 35a^5b^2$

d $x^2 + 7x + 12$

f $x^2 - 11x + 30$

h $x^2 - 3x - 40$

j $36x^2 - 49y^2$

l $18a^2 - 200b^2c^2$

n $6x^2 + 17x + 5$

p $12x^2 - 38x + 20$

9 Simplify the algebraic fractions.

a $\frac{2x^2 + 4x}{x^2 - x}$

b $\frac{x^2 - 5x}{x^2 - 25}$

c $\frac{x^2 - x - 12}{x^2 - 4x}$

d $\frac{2x^2 + 14x}{2x^2 + 4x - 70}$

Completing the square

10 Write the following quadratic expressions in the form $(x + p)^2 + q$

a $x^2 + 4x + 3$

b $x^2 - 10x - 3$

c $x^2 - 8x$

d $x^2 + 6x$

Solving quadratic equations by factorisation

11 Solve

a $x^2 - 3x = 10$

b $x^2 - 3 = 2x$

c $x^2 + 5x = 24$

d $x^2 - 42 = x$

e $x(x + 2) = 2x + 25$

f $x^2 - 30 = 3x - 2$

g $x(3x + 1) = x^2 + 15$

h $3x(x - 1) = 2(x + 1)$

Hint

Get all terms onto one side of the equation.

Solving quadratic equations by using the formula

12 Solve, giving your solutions in surd form.

$$3x^2 + 6x + 2 = 0$$

13 Solve the equation $x^2 - 7x + 2 = 0$

Give your solutions in the form $\frac{a \pm \sqrt{b}}{c}$, where a , b and c are integers.

Solving linear simultaneous equations using the elimination method

14 Solve these simultaneous equations.

a $4x + y = 8$
 $x + y = 5$

b $3x + y = 7$
 $3x + 2y = 5$

c $2x + y = 11$
 $x - 3y = 9$

d $2x + 3y = 11$
 $3x + 2y = 4$

Solving linear and quadratic simultaneous equations

15 Solve these simultaneous equations.

a $y = 2x + 1$
 $x^2 + y^2 = 10$

b $y = 6 - x$
 $x^2 + y^2 = 20$

c $y = x - 3$
 $x^2 + y^2 = 5$

d $y = 9 - 2x$
 $x^2 + y^2 = 17$

e $y = x + 5$
 $x^2 + y^2 = 25$

f $y = 2x - 1$
 $x^2 + xy = 24$

g $y = 2x$
 $y^2 - xy = 8$

h $2x + y = 11$
 $xy = 15$

Linear inequalities

16 Solve these inequalities.

a $\frac{x}{5} < -4$

b $10 \geq 2x + 3$

c $7 - 3x > -5$

d $2 - 4x \geq 18$

e $3 \leq 7x + 10 < 45$

f $6 - 2x \geq 4$

g $-4x \geq 24$

h $3t + 1 < t + 6$

i $2(3n - 1) \geq n + 5$

j $3(2 - x) > 2(4 - x) + 4$

k $5(4 - x) > 3(5 - x) + 2$

Straight line graphs

17 Find the gradient and the y -intercept of the following equations.

- a** $y = 3x + 5$ **b** $y = -\frac{1}{2}x - 7$
c $2y = 4x - 3$ **d** $x + y = 5$
e $2x - 3y - 7 = 0$ **f** $5x + y - 4 = 0$

Hint
Rearrange the equations
to the form $y = mx + c$

18 Copy and complete the table, giving the equation of the line in the form $y = mx + c$.

Gradient	y -intercept	Equation of the line
5	0	
-3	2	
4	-7	

19 Find, in the form $ax + by + c = 0$ where a , b and c are integers, an equation for each of the lines with the following gradients and y -intercepts.

- a** gradient $-\frac{1}{2}$, y -intercept -7 **b** gradient -1.2 , y -intercept -2

20 Write an equation for the line which passes through the point $(2, 5)$ and has gradient 4.

21 Write an equation for the line which passes through the point $(6, 3)$ and has gradient $-\frac{2}{3}$

22 Write an equation for the line passing through each of the following pairs of points.

- a** $(4, 5)$, $(10, 17)$ **b** $(3, 10)$, $(4, 7)$

Parallel and perpendicular lines

23 Find the equation of the line parallel to each of the given lines and which passes through each of the given points.

- a** $y = 3x + 1$ $(3, 2)$ **b** $2y - 3x + 2 = 0$ $(8, 20)$

24 Find the equation of the line perpendicular to each of the given lines and which passes through each of the given points.

- a** $y = 2x - 6$ $(4, 0)$ **b** $5y + 2x - 5 = 0$ $(6, 7)$

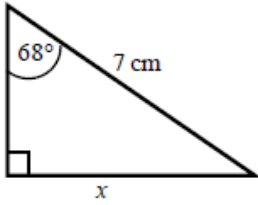
25 In each case find an equation for the line passing through the origin which is also perpendicular to the line joining the two points given.

- a** $(4, 3)$, $(-2, -9)$ **b** $(0, 3)$, $(-10, 8)$

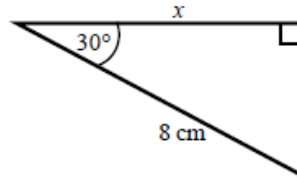
Trigonometry in right-angled triangles

- 26 Calculate the length of the unknown side in each triangle. Give your answers correct to 3 significant figures.

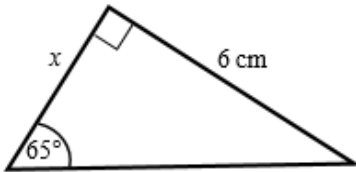
a



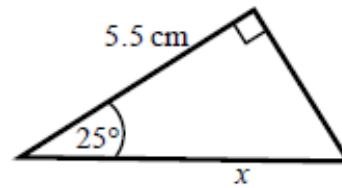
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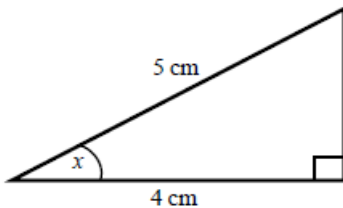


d

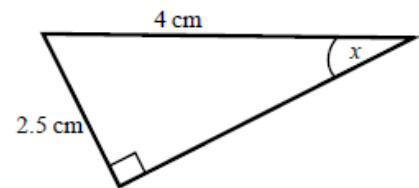


- 27 Calculate the size of angle x in each triangle. Give your answers correct to 1 decimal place.

a



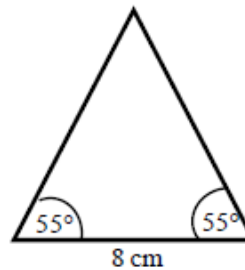
b



- 28 Work out the height of the isosceles triangle. Give your answer correct to 3 significant figures.

Hint:

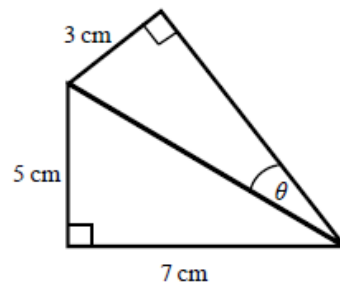
Split the triangle into two right-angled triangles.



- 29 Calculate the size of angle θ . Give your answer correct to 1 decimal place.

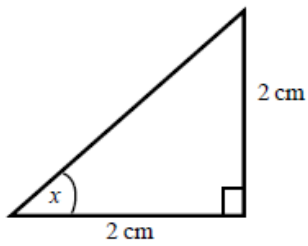
Hint:

First work out the length of the common side to both triangles, leaving your answer in surd form.

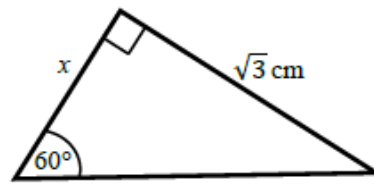


30 Find the exact value of x in each triangle.

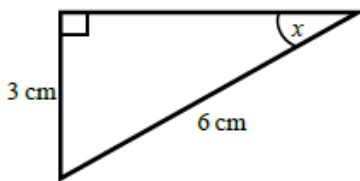
a



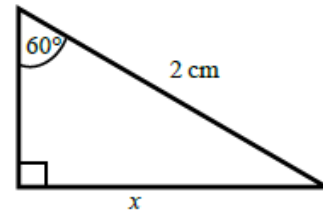
b



c



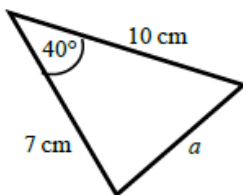
d



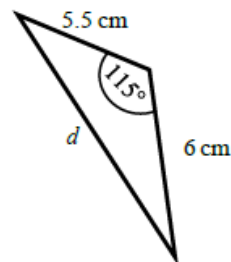
The cosine rule

31 Work out the length of the unknown side in each triangle. Give your answers correct to 3 significant figures.

a

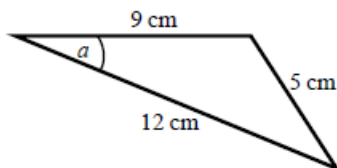


b

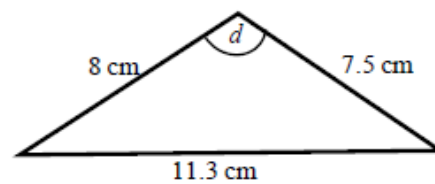


32 Calculate the angles labelled θ in each triangle. Give your answer correct to 1 decimal place.

a

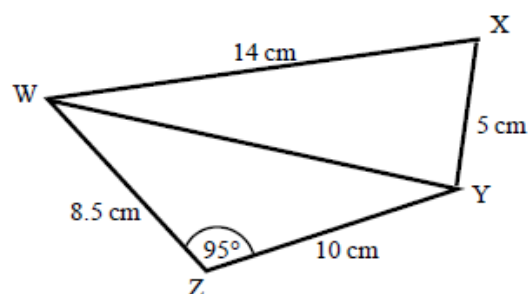


b



33 a Work out the length of WY. Give your answer correct to 3 significant figures.

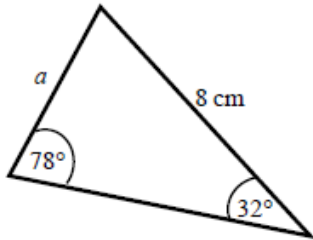
b Work out the size of angle WXY. Give your answer correct to 1 decimal place.



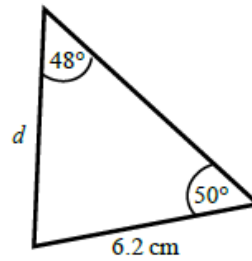
The sine rule

- 34 Find the length of the unknown side in each triangle.
Give your answers correct to 3 significant figures.

a

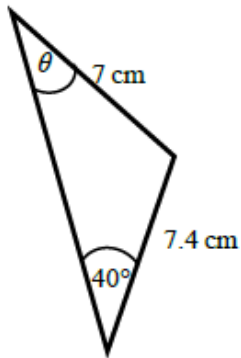


b

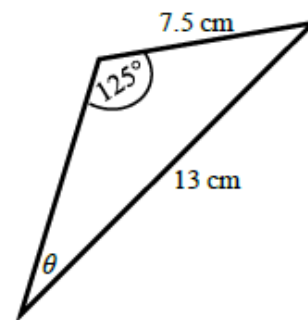


- 35 Calculate the angles labelled θ in each triangle.
Give your answer correct to 1 decimal place.

a

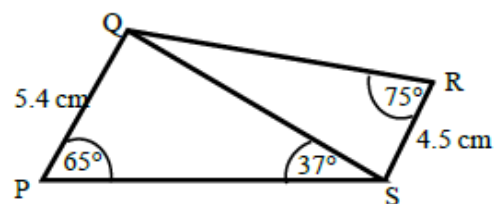


b



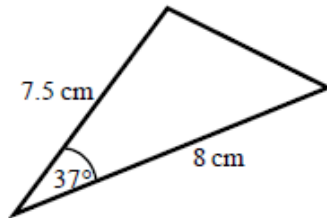
- 36a Work out the length of QS.
Give your answer correct to 3 significant figures.

- b Work out the size of angle RQS.
Give your answer correct to 1 decimal place.

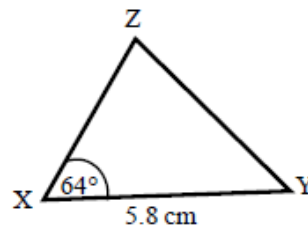


Areas of triangles

- 37 Work out the area of each triangle.
Give your answers correct to 3 significant figures.



- 38 The area of triangle XYZ is 13.3 cm².
Work out the length of XZ.



Rearranging equations

- 39 Change the subject of each formula to the letter given in the brackets.

a $C = \pi d$ [d]	b $P = 2l + 2w$ [w]	c $D = \frac{S}{T}$ [T]
d $p = \frac{q-r}{t}$ [t]	e $u = at - \frac{1}{2}t$ [t]	f $V = ax + 4x$ [x]
g $x = \frac{b-c}{d}$ [d]	h $h = \frac{7g-9}{2+g}$ [g]	
i $e(9+x) = 2e + 1$ [e]	j $y = \frac{2x+3}{4-x}$ [x]	

- 40 Make r the subject of the following formulae.

a $A = \pi r^2$	b $V = \frac{4}{3}\pi r^3$	c $P = \pi r + 2r$	d $V = \frac{2}{3}\pi r^2 h$
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- 41 Make x the subject of the following formulae.

a $\frac{xy}{z} = \frac{ab}{cd}$	b $\frac{4\pi cx}{d} = \frac{3z}{py^2}$
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- 42 Make $\sin B$ the subject of the formula $\frac{a}{\sin A} = \frac{b}{\sin B}$

- 43 Make $\cos B$ the subject of the formula $b^2 = a^2 + c^2 - 2ac \cos B$.

10 a $(x+2)^2 - 1$

b $(x-5)^2 - 28$

c $(x-4)^2 - 16$

d $(x+3)^2 - 9$

11 a $x = -2$ or $x = 5$

b $x = -1$ or $x = 3$

c $x = -8$ or $x = 3$

d $x = -6$ or $x = 7$

e $x = -5$ or $x = 5$

f $x = -4$ or $x = 7$

g $x = -3$ or $x = 2\frac{1}{2}$

h $x = -\frac{1}{3}$ or $x = 2$

12 $x = -1 + \frac{\sqrt{3}}{3}$ or $x = -1 - \frac{\sqrt{3}}{3}$

13 $x = \frac{7 + \sqrt{41}}{2}$ or $x = \frac{7 - \sqrt{41}}{2}$

14a $x = 1, y = 4$

b $x = 3, y = -2$ **c** $x = 6, y = -1$ **d** $x = -2, y = 5$

15a $x = 1, y = 3$

$x = -\frac{9}{5}, y = -\frac{13}{5}$

15b $x = 2, y = 4$

$x = 4, y = 2$

15c $x = 1, y = -2$

$x = 2, y = -1$

15d $x = 4, y = 1$

$x = \frac{16}{5}, y = \frac{13}{5}$

15e $x = 0, y = 5$

$x = -5, y = 0$

15f $x = -\frac{8}{3}, y = -\frac{19}{3}$

$x = 3, y = 5$

15g $x = -2, y = -4$

$x = 2, y = 4$

15h $x = \frac{5}{2}, y = 6$

$x = 3, y = 5$

16 a $x < -20$ b $x \leq 3.5$ c $x < 4$ d $x \leq -4$

e $-1 \leq x < 5$ f $x \leq 1$ g $x \leq -6$ h $t < \frac{5}{2}$

i $n \geq \frac{7}{5}$ j $x < -6$ k $x < \frac{3}{2}$

17 a $m = 3, c = 5$ b $m = -\frac{1}{2}, c = -7$ c $m = 2, c = -\frac{3}{2}$

d $m = -1, c = 5$ e $m = \frac{2}{3}, c = -\frac{7}{3}$ or $-2\frac{1}{3}$ f $m = -5, c = 4$

18

Gradient	y-intercept	Equation of the line
5	0	$y = 5x$
-3	2	$y = -3x + 2$
4	-7	$y = 4x - 7$

19 a $x + 2y + 14 = 0$ b $6x + 5y + 10 = 0$

20 $y = 4x - 3$

21 $y = -\frac{2}{3}x + 7$

22 a $y = 2x - 3$ b $y = -3x + 19$

23 a $y = 3x - 7$ b $y = \frac{3}{2}x + 8$

24 a $y = -\frac{1}{2}x + 2$ b $y = \frac{5}{2}x - 8$

25 a $y = -\frac{1}{2}x$ b $y = 2x$

26 a 6.49 cm b 6.93 cm c 2.80 cm d 6.07 cm

27 a 36.9° b 38.7°

28 5.71 cm

29 20.4°

30 a 45° b 1 cm c 30° d $\sqrt{3}$ cm

31 a 6.46 cm b 9.70 cm

32 a 22.2° b 93.6°

33 a 13.7 cm b 76.0°

34 a 4.33 cm b 6.39 cm

35 a 42.8° b 28.2°

36 a 8.13 cm b 32.3°

37 18.1 cm^2 38 5.10 cm

39a $d = \frac{C}{\pi}$ b $w = \frac{P-2l}{2}$ c $T = \frac{S}{D}$

d $t = \frac{q-r}{p}$ e $t = \frac{2u}{2a-1}$ f $x = \frac{V}{a+4}$

g $d = \frac{b-c}{x}$ h $g = \frac{2h+9}{7-h}$ i $e = \frac{1}{x+7}$ j $x = \frac{4y-3}{2+y}$

40 a $r = \sqrt{\frac{A}{\pi}}$ b $r = \sqrt[3]{\frac{3V}{4\pi}}$

c $r = \frac{P}{\pi+2}$ d $r = \sqrt{\frac{3V}{2\pi h}}$

41 a $x = \frac{abz}{cdy}$ b $x = \frac{3dz}{4\pi cpy^2}$

42 $\sin B = \frac{b \sin A}{a}$

43 $\cos B = \frac{a^2 + c^2 - b^2}{2ac}$