

# GETTING READY FOR A-LEVEL MATHEMATICS:

## Practice Questions:

### **10 Bridging Topics to prepare you for A level Maths:**

1. Expanding brackets and simplifying expressions
2. Rearranging equations
3. Rules of indices
4. Factorising expressions
5. Completing the square
6. Solving quadratic equations
7. Solving linear simultaneous equations
8. Linear inequalities
9. Straight line graphs
10. Trigonometry

# Expanding brackets & simplifying expressions

1 Expand.

a  $3(2x - 1)$

c  $-(3xy - 2y^2)$

b  $-2(5pq + 4q^2)$

2 Expand and simplify.

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

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

b  $8(5p - 2) - 3(4p + 9)$

d  $2(4x - 3) - (3x + 5)$

3 Expand.

a  $3x(4x + 8)$

c  $-2h(6h^2 + 11h - 5)$

b  $4k(5k^2 - 12)$

d  $-3s(4s^2 - 7s + 2)$

4 Expand and simplify.

a  $3(y^2 - 8) - 4(y^2 - 5)$

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

b  $2x(x + 5) + 3x(x - 7)$

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

5 Expand  $\frac{1}{2}(2y - 8)$

6 Expand and simplify.

a  $13 - 2(m + 7)$

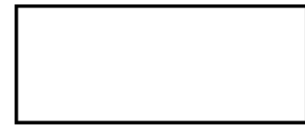
b  $5p(p^2 + 6p) - 9p(2p - 3)$

7 The diagram shows a rectangle.

Write down an expression, in terms of  $x$ , for the area of the rectangle.

Show that the area of the rectangle can be written as  $21x^2 - 35x$

$3x - 5$



$7x$

8 Expand and simplify.

a  $(x + 4)(x + 5)$

c  $(x + 7)(x - 2)$

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

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

i  $(3x + 4y)(5y + 6x)$

k  $(2x - 7)^2$

b  $(x + 7)(x + 3)$

d  $(x + 5)(x - 5)$

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

h  $(3x - 2)(7 + 4x)$

j  $(x + 5)^2$

l  $(4x - 3y)^2$

## Extend

9 Expand and simplify  $(x + 3)^2 + (x - 4)^2$

10 Expand and simplify.

a  $\left(x + \frac{1}{x}\right)\left(x - \frac{2}{x}\right)$

b  $\left(x + \frac{1}{x}\right)^2$

### Watch out!

When multiplying (or dividing) positive and negative numbers, if the signs are the same the answer is '+'; if the signs are different the answer is '-'

# Rearranging equations

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

1  $C = \pi d$  [ $d$ ]

2  $P = 2l + 2w$  [ $w$ ]

3  $D = \frac{S}{T}$  [ $T$ ]

4  $p = \frac{q-r}{t}$  [ $t$ ]

5  $u = at - \frac{1}{2}t$  [ $t$ ]

6  $V = ax + 4x$  [ $x$ ]

7  $\frac{y-7x}{2} = \frac{7-2y}{3}$  [ $y$ ]

8  $x = \frac{2a-1}{3-a}$  [ $a$ ]

9  $x = \frac{b-c}{d}$  [ $d$ ]

10  $h = \frac{7g-9}{2+g}$  [ $g$ ]

11  $e(9+x) = 2e + 1$  [ $e$ ]

12  $y = \frac{2x+3}{4-x}$  [ $x$ ]

13 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  $V = \frac{2}{3}\pi r^2 h$

14 Make  $x$  the subject of the following formulae.

a  $\frac{xy}{z} = \frac{ab}{cd}$

b  $\frac{4\pi cx}{d} = \frac{3z}{py^2}$

15 Make  $\sin B$  the subject of the formula  $\frac{a}{\sin A} = \frac{b}{\sin B}$

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

## Extend

17 Make  $x$  the subject of the following equations.

a  $\frac{p}{q}(sx+t) = x-1$

b  $\frac{p}{q}(ax+2y) = \frac{3p}{q^2}(x-y)$

# Rules of indices

1 Evaluate.

a  $14^0$

b  $3^0$

c  $5^0$

d  $x^0$

2 Evaluate.

a  $49^{\frac{1}{2}}$

b  $64^{\frac{1}{3}}$

c  $125^{\frac{1}{3}}$

d  $16^{\frac{1}{4}}$

3 Evaluate.

a  $25^{\frac{3}{2}}$

b  $8^{\frac{5}{3}}$

c  $49^{\frac{3}{2}}$

d  $16^{\frac{3}{4}}$

4 Evaluate.

a  $5^{-2}$

b  $4^{-3}$

c  $2^{-5}$

d  $6^{-2}$

5 Simplify.

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

b  $\frac{10x^5}{2x^2 \times x}$

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

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

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

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

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

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

**Watch out!**

Remember that any value raised to the power of zero is 1. This is the rule  $a^0 = 1$ .

6 Evaluate.

a  $4^{-\frac{1}{2}}$

b  $27^{-\frac{2}{3}}$

c  $9^{-\frac{1}{2}} \times 2^3$

d  $16^{\frac{1}{4}} \times 2^{-3}$

e  $\left(\frac{9}{16}\right)^{-\frac{1}{2}}$

f  $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$

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

**8** Write the following without negative or fractional powers.

**a**  $x^{-3}$

**b**  $x^0$

**c**  $x^{\frac{1}{5}}$

**d**  $x^{\frac{2}{5}}$

**e**  $x^{-\frac{1}{2}}$

**f**  $x^{\frac{3}{4}}$

**9** Write the following in the form  $ax^n$ .

**a**  $5\sqrt{x}$

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

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

**d**  $\frac{2}{\sqrt{x}}$

**e**  $\frac{4}{\sqrt[3]{x}}$

**f** 3

## Extend

**10** Write as sums of powers of  $x$ .

**a**  $\frac{x^5 + 1}{x^2}$

**b**  $x^2\left(x + \frac{1}{x}\right)$

**c**  $x^{-4}\left(x^2 + \frac{1}{x^3}\right)$

# Factorising expressions

1 Factorise.

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

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

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

2 Factorise

a  $x^2 + 7x + 12$

c  $x^2 - 11x + 30$

e  $x^2 - 7x - 18$

g  $x^2 - 3x - 40$

b  $x^2 + 5x - 14$

d  $x^2 - 5x - 24$

f  $x^2 + x - 20$

h  $x^2 + 3x - 28$

3 Factorise

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

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

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

4 Factorise

a  $2x^2 + x - 3$

c  $2x^2 + 7x + 3$

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

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

d  $9x^2 - 15x + 4$

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

5 Simplify the algebraic fractions.

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

c  $\frac{x^2 - 2x - 8}{x^2 - 4x}$

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

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

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

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

6 Simplify

a  $\frac{9x^2 - 16}{3x^2 + 17x - 28}$

c  $\frac{4 - 25x^2}{10x^2 - 11x - 6}$

b  $\frac{2x^2 - 7x - 15}{3x^2 - 17x + 10}$

d  $\frac{6x^2 - x - 1}{2x^2 + 7x - 4}$

## Hint

Take the highest common factor outside the bracket.

## Extend

7 Simplify  $\sqrt{x^2 + 10x + 25}$

8 Simplify  $\frac{(x+2)^2 + 3(x+2)^2}{x^2 - 4}$

# Completing the square

1 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  $x^2 + 6x$

e  $x^2 - 2x + 7$

f  $x^2 + 3x - 2$

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

a  $2x^2 - 8x - 16$

b  $4x^2 - 8x - 16$

c  $3x^2 + 12x - 9$

d  $2x^2 + 6x - 8$

3 Complete the square.

a  $2x^2 + 3x + 6$

b  $3x^2 - 2x$

c  $5x^2 + 3x$

d  $3x^2 + 5x + 3$

## Extend

4 Write  $(25x^2 + 30x + 12)$  in the form  $(ax + b)^2 + c$ .

# Solving quadratic equations by factorisation

1 Solve

a  $6x^2 + 4x = 0$

c  $x^2 + 7x + 10 = 0$

e  $x^2 - 3x - 4 = 0$

g  $x^2 - 10x + 24 = 0$

i  $x^2 + 3x - 28 = 0$

k  $2x^2 - 7x - 4 = 0$

b  $28x^2 - 21x = 0$

d  $x^2 - 5x + 6 = 0$

f  $x^2 + 3x - 10 = 0$

h  $x^2 - 36 = 0$

j  $x^2 - 6x + 9 = 0$

l  $3x^2 - 13x - 10 = 0$

2 Solve

a  $x^2 - 3x = 10$

c  $x^2 + 5x = 24$

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

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

b  $x^2 - 3 = 2x$

d  $x^2 - 42 = x$

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

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

**Hint**

Get all terms  
onto one side  
of the

# Solving quadratic equations by completing the square

3 Solve by completing the square.

a  $x^2 - 4x - 3 = 0$

c  $x^2 + 8x - 5 = 0$

e  $2x^2 + 8x - 5 = 0$

b  $x^2 - 10x + 4 = 0$

d  $x^2 - 2x - 6 = 0$

f  $5x^2 + 3x - 4 = 0$

4 Solve by completing the square.

a  $(x - 4)(x + 2) = 5$

b  $2x^2 + 6x - 7 = 0$

c  $x^2 - 5x + 3 = 0$

**Hint**

Get all terms  
onto one side  
of the



# Solving quadratic equations by using the formula

5 Solve, giving your solutions in surd form.

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

**b**  $2x^2 - 4x - 7 = 0$

6 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.

7 Solve  $10x^2 + 3x + 3 = 5$

Give your solution in surd form.

**Hint**

Get all terms onto one side of the equation.

## Extend

8 Choose an appropriate method to solve each quadratic equation, giving your answer in surd form when necessary.

**a**  $4x(x - 1) = 3x - 2$

**b**  $10 = (x + 1)^2$

**c**  $x(3x - 1) = 10$

# Solving linear simultaneous equations using the elimination method

Solve these simultaneous equations.

1  $4x + y = 8$   
 $x + y = 5$

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

3  $4x + y = 3$   
 $3x - y = 11$

4  $3x + 4y = 7$   
 $x - 4y = 5$

5  $2x + y = 11$   
 $x - 3y = 9$

6  $2x + 3y = 11$   
 $3x + 2y = 4$

# Solving linear simultaneous equations using the substitution method

Solve these simultaneous equations.

7  $y = x - 4$   
 $2x + 5y = 43$

8  $y = 2x - 3$   
 $5x - 3y = 11$

9  $2y = 4x + 5$   
 $9x + 5y = 22$

10  $2x = y - 2$   
 $8x - 5y = -11$

11  $3x + 4y = 8$   
 $2x - y = -13$

12  $3y = 4x - 7$   
 $2y = 3x - 4$

13  $3x = y - 1$   
 $2y - 2x = 3$

14  $3x + 2y + 1 = 0$   
 $4y = 8 - x$

## Extend

15 Solve the simultaneous equations  $3x + 5y - 20 = 0$  and  $2(x + y) = \frac{3(y - x)}{4}$ .

# Linear inequalities

1 Solve these inequalities.

**a**  $4x > 16$

**b**  $5x - 7 \leq 3$

**c**  $1 \geq 3x + 4$

**d**  $5 - 2x < 12$

**e**  $\frac{x}{2} \geq 5$

**f**  $8 < 3 - \frac{x}{3}$

2 Solve these inequalities.

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

**b**  $10 \geq 2x + 3$

**c**  $7 - 3x > -5$

3 Solve

**a**  $2 - 4x \geq 18$

**b**  $3 \leq 7x + 10 < 45$

**c**  $6 - 2x \geq 4$

**d**  $4x + 17 < 2 - x$

**e**  $4 - 5x < -3x$

**f**  $-4x \geq 24$

4 Solve these inequalities.

**a**  $3t + 1 < t + 6$

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

5 Solve.

**a**  $3(2 - x) > 2(4 - x) + 4$

**b**  $5(4 - x) > 3(5 - x) + 2$

## Extend

6 Find the set of values of  $x$  for which  $2x + 1 > 11$  and  $4x - 2 > 16 - 2x$ .

# Straight line graphs

1 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  $y = mx + c$

2 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	

3 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 2,  $y$ -intercept 0

c gradient  $\frac{2}{3}$ ,  $y$ -intercept 4

d gradient  $-1.2$ ,  $y$ -intercept  $-2$

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

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

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

a  $(4, 5)$ ,  $(10, 17)$

b  $(0, 6)$ ,  $(-4, 8)$

c  $(-1, -7)$ ,  $(5, 23)$

d  $(3, 10)$ ,  $(4, 7)$

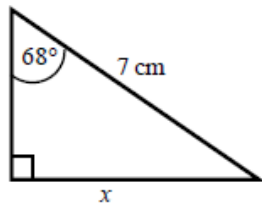
## Extend

7 The equation of a line is  $2y + 3x - 6 = 0$ .  
Write as much information as possible about this line.

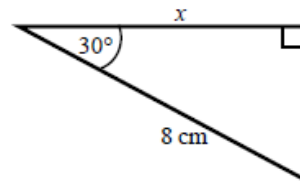
# Trigonometry in right-angled triangles

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

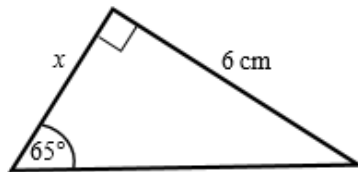
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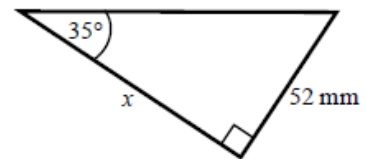
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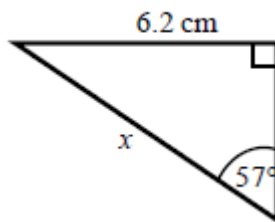
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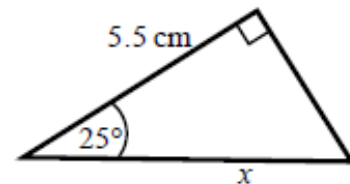
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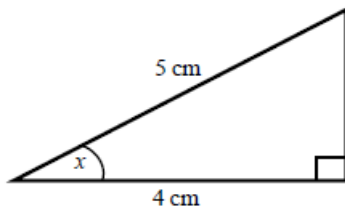


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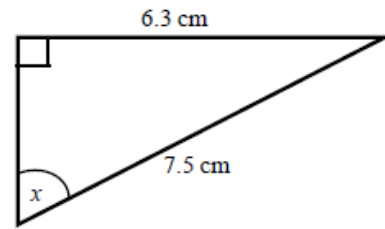


- 2 Calculate the size of angle  $x$  in each triangle. Give your answers correct to 1 decimal place.

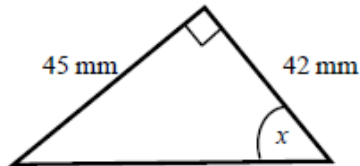
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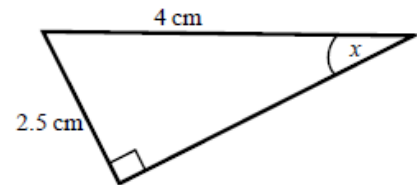
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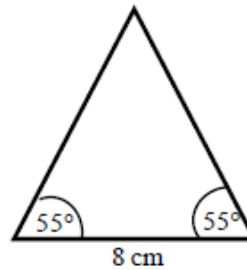
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- 3 Work out the height of the isosceles triangle. Give your answer correct to 3 significant figures.

**Hint:**

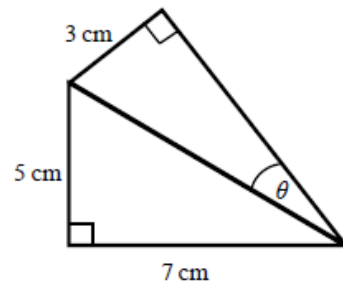
Split the triangle into two right-angled triangles.



- 4 Calculate the size of angle  $\theta$ . Give your answer correct to 1 decimal place.

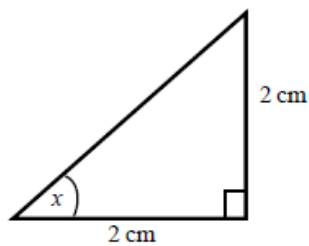
**Hint:**

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

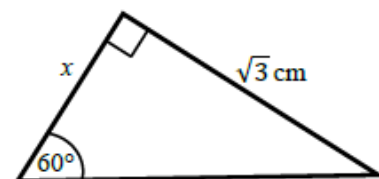


- 5 Find the exact value of  $x$  in each triangle.

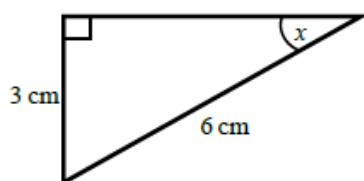
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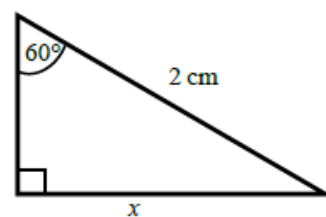
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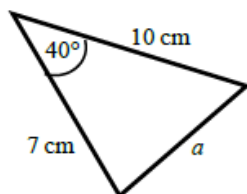
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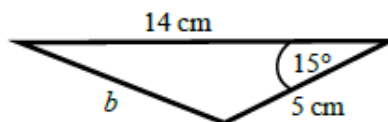
# The cosine rule

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

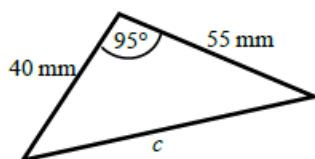
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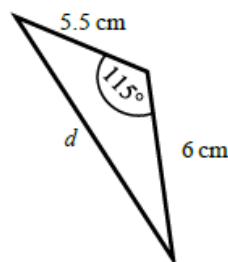
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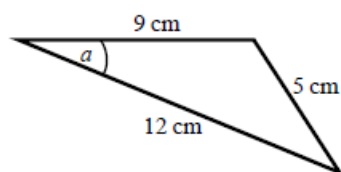


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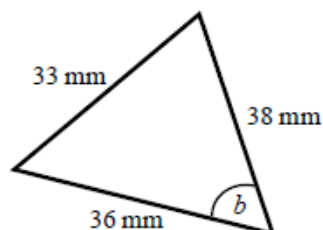


- 7 Calculate the angles labelled  $\theta$  in each triangle.  
Give your answer correct to 1 decimal place.

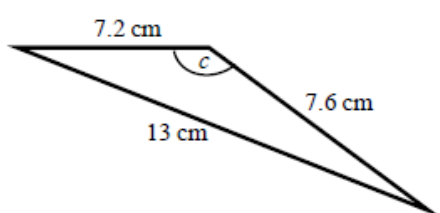
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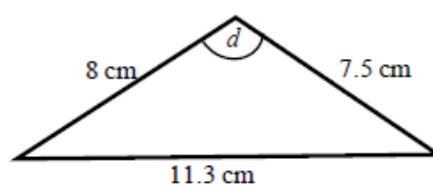
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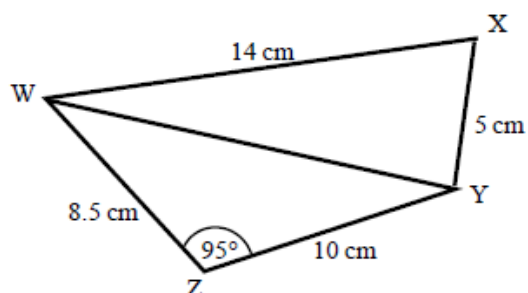


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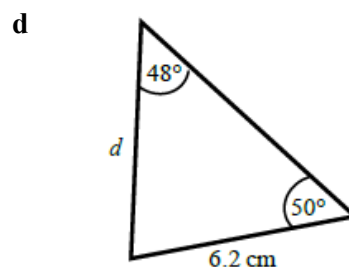
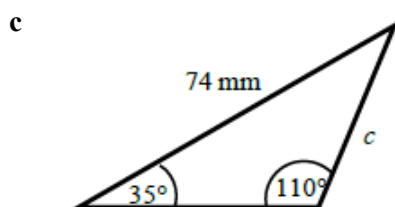
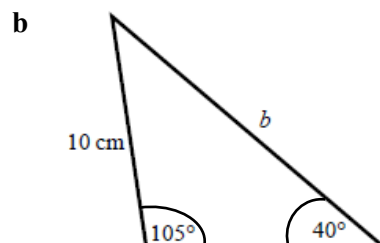
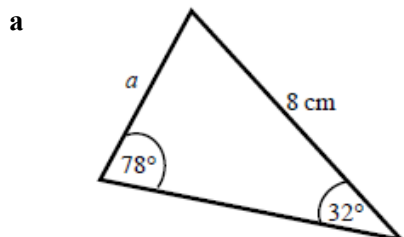
- 8 a Work out the length of WY.  
Give your answer correct to 3 significant figures.

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

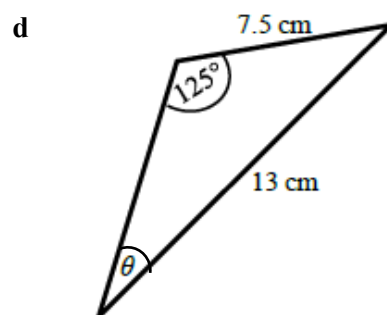
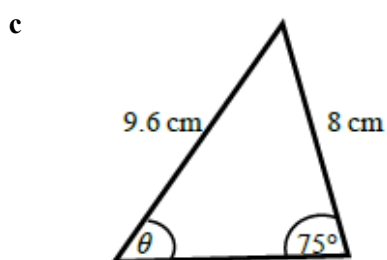
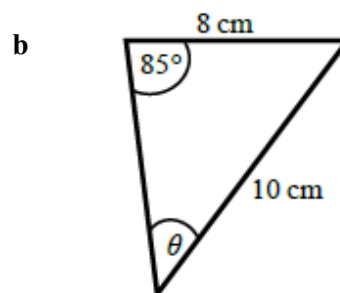
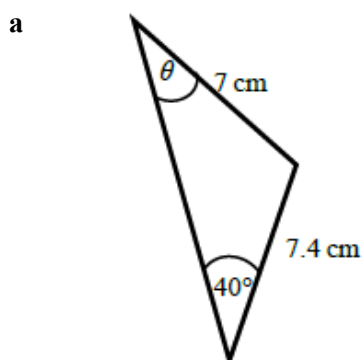


# The sine rule

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

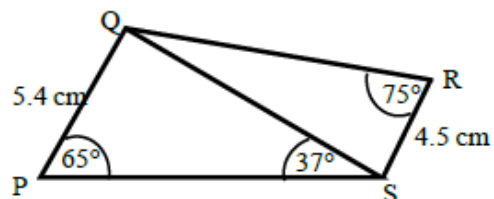


- 10 Calculate the angles labelled  $\theta$  in each triangle.  
Give your answer correct to 1 decimal place.





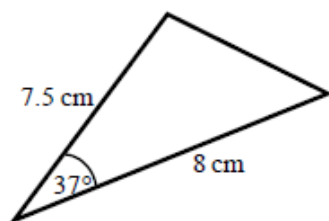
- 11 a Work out the length of QS.  
Give your answer correct to 3 significant figures.
- b Work out the size of angle RQS.  
Give your answer correct to 1 decimal place.



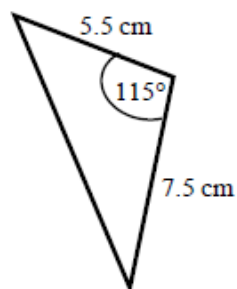
## Areas of triangles

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

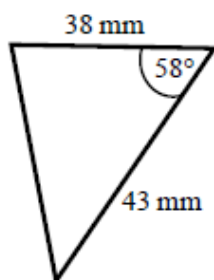
a



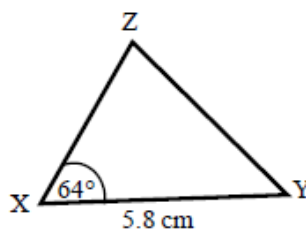
b



c



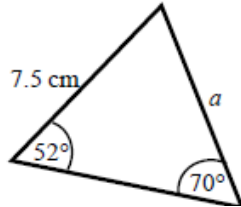
- 13 The area of triangle XYZ is 13.3 cm<sup>2</sup>.  
Work out the length of XZ.



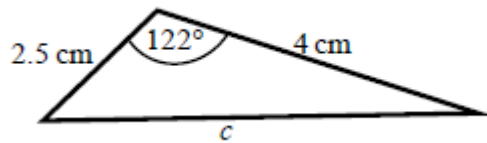
## Extend

- 14 Find the size of each lettered angle or side.  
Give your answers correct to 3 significant figures.

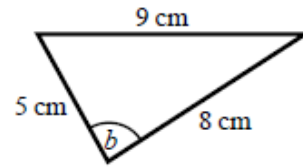
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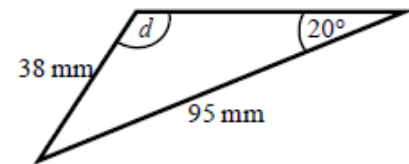
c



b



d



**Hint:**

For each one, decide whether to use the cosine or sine rule.

- 15 The area of triangle ABC is  $86.7 \text{ cm}^2$ .  
Work out the length of BC.  
Give your answer correct to 3 significant figures.

