S3 Level 4 → N5 HOMEWORK EXERCISE No. 1

1. Express as vulgar fractions in their simplest form:

   (i) 60% (ii) 37½%

2. Express as percentages:

   (i) $\frac{1}{4}$ (ii) $\frac{2}{3}$ (iii) $\frac{5}{14}$

   [Round (ii) and (iii) to 3 significant figures]

3. Jack opens a deposit account which offers interest at 3% per annum. How much interest would he receive on £225 invested for 9 months.

4. If £2500 is invested at 2.3% interest per annum. How much compound interest would the saver get after 4 years?

5. A new car cost £14500. The value of the car depreciated by 15% after the first year and by 8% after the second year.
   Calculate the value of the car after two years

6. Sally works in a shop and was told to increase prices by 12%. She increased one price to £168.56. What was the original price?

7. If a = -2, b = -4, c = 3 and d = -3, calculate:

   (i) abc (ii) 2d – ab (iii) $(bc)^2$ (iv) bc^2

8. Calculate:
   (i) -6 -8 (ii) 9 + (-3) (iii) -3 – (-2)
   (iv) $\frac{-24}{-8}$ (v) $(-2)^3$ (vi) $-(-5)^2$

9. Find all possible solutions to these equations:

   (i) -3y = 12 (ii) $x^2 = 1$ (iii) $z^3 = -64$

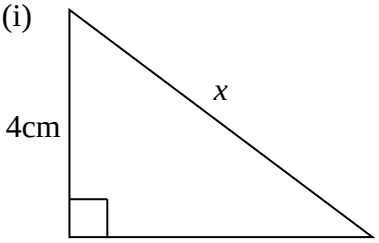
S3 Level 4 → N5 HOMEWORK EXERCISE No. 2

1. A woman opens a deposit account which offers interest at 3% per annum. How much interest would be received on £225 invested for 9 months.

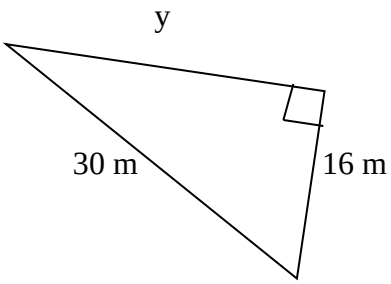
2. When 8 is divided by 3, the remainder is 2. What is the remainder when 5987631 is divided by 22307? [Show full working. Answer is **not** 0.4193751]

3. Use Pythagoras' Theorem to calculate the unknown side of each triangle.

(i)



(ii)



Give both answers rounded correctly to 2 decimal places.

4. Simplify the following

(i) $a^5 \times a^3$ (ii) $(b^3)^2$ (iii) $\frac{C^8}{C^6}$

(iv) $(d^{-3})^4$ (v) $e^{-3} \times e^{-2}$ (vi) $f^{-1} \div f^{-2}$

Write each answer with a positive index.

5. Calculate and express the answers in scientific notation

(i) $(1.8 \times 10^{11}) \times (3.7 \times 10^5)$ (ii) $(8 \times 10^{17}) \div (8.3 \times 10^3)$

Round to 3 significant figures.

6. If a house valued at £250 000 appreciates in value by an average of 2.6% per year for 4 years. How much will it be worth at the end of the 4 years.

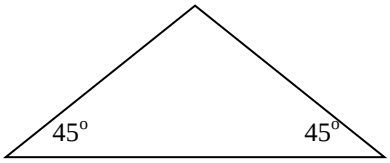
7. Jamie is going to bake cakes for a party. He needs $^2/_5$ of a block of butter for 1 cake. He has 7 blocks of butter. How many cakes can he make?

S3 Level 4 → N5 HOMEWORK EXERCISE No. 3

1. A woman invests £5000 in a building society account which gathers interest at 3% per annum compounded.
   How much will she have in her account after 3 years, assuming that she makes no deposits or withdrawals during this period?

2. Without using a calculator, express as a vulgar fraction in its simplest form:

   (i) $\frac{2}{3} + \frac{1}{4}$ (ii) $\frac{2}{7} \times \frac{5}{6}$

3. 

10cm

   Find the length of the other two sides of this isosceles triangle correct to 2 decimal places.

4. Expand the brackets and simplify where possible.

a) $3(x - 5)$ b) $5(x - 2) + 2(3x + 7)$ c) $1 - 4(3p - 4)$

5. The total number of visitors to The Modern House Exhibition was 1.425×10^5.
   The exhibition was open each day from the 1st June to the 14th September **inclusive**.
   Calculate the average number of visitors per day to the exhibition, to 3 significant figures.

6. A barrel can hold 43 litres when full. If 25 litres of water is poured into an empty barrel, what percentage of the barrel is filled? Give your answer correct to 4 significant figures?

7. The lock on a safe can be opened when the correct number combination is used.
   It is known that each number in the sequence, after the first two, is the sum of the two immediately before it.

   3, *x*, …, …, 36

   (i) Let the second number be *x*. Write down an **algebraic expression** for the third and fourth numbers **in terms of *x***.

   (ii) Form an equation in *x* and solve to find the correct combination.

S3 Level 4 → N5 HOMEWORK EXERCISE No. 4

1. Write the following in their simplest form: [e.g. $\frac{kx6}{2} = 3k$]

   (i) $4 \times 3y$ (ii) $-4 \times t \times (-1)$

   (iii) $2c \times (-3) \times c$ (iv) $\frac{2 \times f \times (-5)}{5 \times f}$

2. Solve these equations showing your steps:

   (i) $3x - 2 = x + 10$ (ii) $5(x - 2) + 3 = 2(x + 3)$

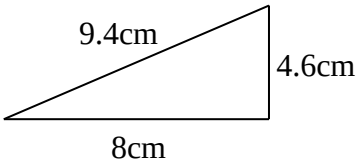
3. Kirsty scored 17 out of 23 in a maths test and 29 out of 38 in a physics test. Which was the better score.
   You must justify your answer.

4. James bought a car last year. It has lost 15% of its value since then.
   It is now valued at £12 920. How much did James pay for his car?

5. In 2009, a house was valued at £165 000 and the contents were valued at £45 000.
   The value of the house **appreciates** by 7% each year.
   The value of the contents **depreciates** by 9% each year.
   What will be the **total** value of the house **and** contents in 2012?

6. Calculate the value of 2^{-6},leaving your answer as a vulgar fraction in its simplest form.

7. Prove that this triangle is not right angled.



S3 Level 4 → N5 HOMEWORK EXERCISE No. 5

1. Expand the brackets and simplify.
   a) $(x + 5)(x + 2)$ b) $(x + 6)(x - 7)$ c) $(2x - 5)(3x - 4)$
   d) $(x - 2)(x^2 + 3x - 1)$

2. One atom of gold weighs 3.27×10^{-27} g. How many atoms will be in a kilogram of gold?
   Give your answer in scientific notation correct to 2 significant figures.

3. Simplify the following inequations showing all steps:

   (i) $5a - 6 < 4$ (ii) $7b + 2 \geq 5b - 6$

4. $x^2 + y^2 + z^2 = 1085$ and x^2, y^2 and z^2 are consecutive square numbers. Find x, y and z, showing your method clearly.

5. Bacteria in a test tube increase at the rate of 0.9% per hour. At 12 noon there are 4500 bacteria. At 3pm, how many bacteria will be present? Give your answer correct **to 3 significant figures**.

6. Express as vulgar fractions in their simplest form:

   (i) $\frac{17}{20} - \frac{3}{5}$

   (ii) $\frac{3}{8} \div \frac{5}{6}$

7. A sequence of terms, starting with 1, is

1, 5, 9, 13, 17, …..

Consecutive terms in this sequence are formed by adding 4 to the previous term.
The total of consecutive terms of this sequence can be found using the following pattern.

Total of the first 2 terms: 1 + 5	$= 2 \times 3$
Total of the first 3 terms: 1 + 5 + 9	$= 3 \times 5$
Total of the first 4 terms: 1 + 5 + 9 + 13	$= 4 \times 7$
Total of the first 5 terms: 1 + 5 + 9 + 13 + 17	$= 5 \times 9$

i) Express the total of the first 9 terms of this sequence in the same way.

ii) The first n terms of this sequence are added.
Write down an expression, in n, for the total.

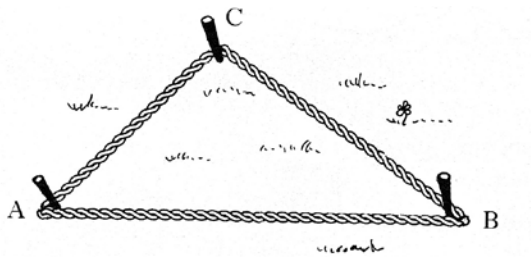
S3 Level 4 → N5 HOMEWORK EXERCISE No. 6

1. Solve these equations:

   (i) $3(x + 2) - 9 = 0$ (ii) $8 = 3 - 4(x - 2)$
   (iii) $18 - (2x + 1) = x - 1$

2. The cost of a meal at a local restaurant has gone up by 8%.
   What was the cost of a meal that is now priced at £12.96?

3. A loop of rope is used to mark out a triangular plot, ABC.
   The loop of rope measures 6 metres.
   Pegs are positioned at A and B such that AB is 2.5 metres.
   The third peg is positioned at C such that BC is 2 metres.
   Prove that angle ACB = 90°.
   Do not use a scale drawing.



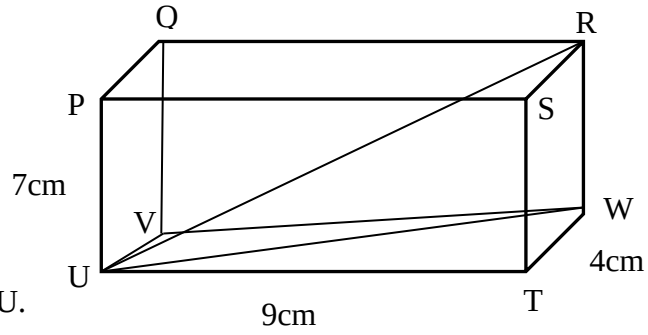
4. Expand the brackets and simplify
   i) $(2x + 4)(x - 7)$ ii) $(3x - 7)(2x - 4)$ iii) $(x - 6)(x + 6)$

5. Simplify the following:

   (i) $g^6 \times g^{-4}$ (ii) $\frac{h^3}{h^{-3}}$ (iii) $(3k^2)^3$

6. PQRSTUVW is a cuboid with length 9cm, breadth 4cm and height 7cm, as shown on the diagram.

   Calculate the length of the space diagonal RU.



S3 Level 4 → N5 HOMEWORK EXERCISE No. 7

1. Multiply out, and simplify:

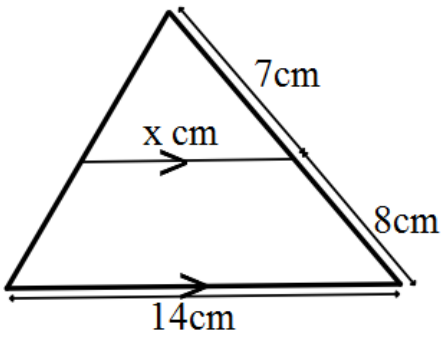
   (i) $(x + 1)(x + 2)$ (ii) $(y – 3)(y + 5)$
   (iii) $(t – 7)(t – 2)$ (iv) $(4b – 1)(b + 1)$
   (v) $(4k – 1)(2k – 3)$ (vi) $2(2c + 1)(5c + 2)$

2. The mass of a proton is approximately 1.8×10^{3} times greater than the mass of an electron. If the mass of an electron is 9.11×10^{-31} kg, calculate the mass of a proton. Give your answer in **scientific notation correct to 2 significant figures.**

3. Write the following in their simplest form:

   (i) $y \times 6$ (ii) $-2 \times (-t) \times 5$ (iii) $3k \times k$
   (iv) $-2c \times (-3) \times (-4c)$ (v) $\frac{-2x(-g)x3g^2}{gx(-g)}$

4. Calculate x in the diagram below.



5. Calculate 34% of £2.40 showing clearly the **simplest** method **without** using a calculator.

6. Calculate $\frac{7}{9} \times \left(2\frac{3}{7} - 1\frac{7}{8}\right)$ **without** a calculator, showing all working.

7. In 1995, the price of 1 litre of a certain kind of petrol was 54.9 pence.
   By 1996, the price of 1 litre of the same kind of petrol had risen to 56.3 pence.
   The percentage increase for each of the next four years is expected to be the same as the percentage increase between 1995 and 1996.
   What is the price of 1 litre of petrol expected to be in the year 2000?

S3 Level 4 → N5 HOMEWORK EXERCISE No. 8

1. Calculate in simplest form:

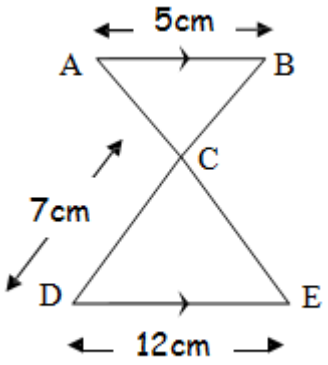
   (i) $3\frac{1}{2} \times 2\frac{3}{5}$ (ii) $4\frac{5}{6} \div 2\frac{2}{3}$ (iii) $2\frac{4}{5} - 1\frac{2}{7}$ (iv) $3\frac{1}{2} + 1\frac{2}{3}$

2. Multiply out, and simplify:

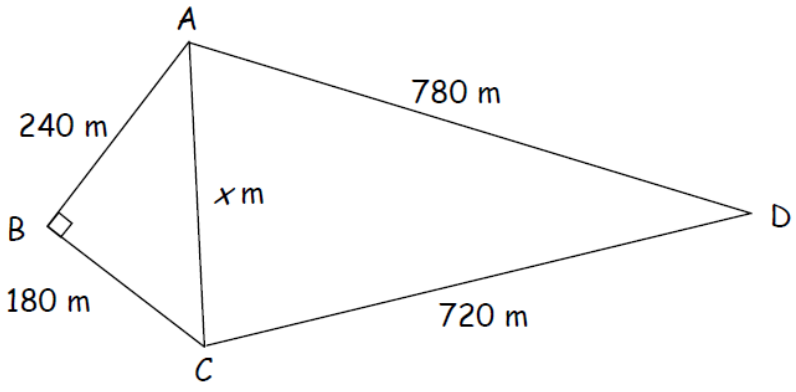
   (i) $(3x - 1)(x + 1)$ (ii) $(4x - 7)^2$
   (iii) $(x + 2)(x^2 - 3x + 1)$ (iv) $(x + 1)^3$

3. A car is valued at £3780.
   This is 16% less than last year's value.
   What was the value of the car last year?

4. Calculate the length of the line BC.



5. Show that triangle ACD is right angled.



S3 Level 4 → N5 HOMEWORK EXERCISE No. 9

1. Simplify the following leaving your answers with positive powers:

   (i) $2a^{-5} \times 5a^{-4}$ (ii) $(4b^3)^2$ (iii) $\frac{15c^2}{3c^3}$

2. Evaluate:

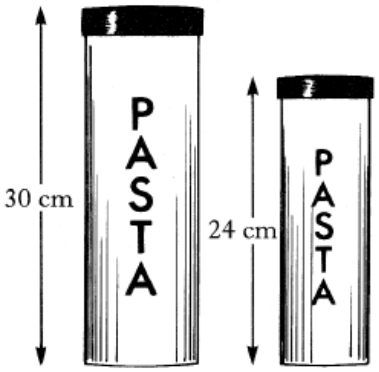
   (i) 12° (ii) 6^{-3}, leaving the answer as a fraction in its simplest form.

3. Solve these equations:

   (i) $(x + 2)(x + 1) = (x - 2)^2$ (ii) $(5 - 2x)^2 = 4(x - 3)^2$

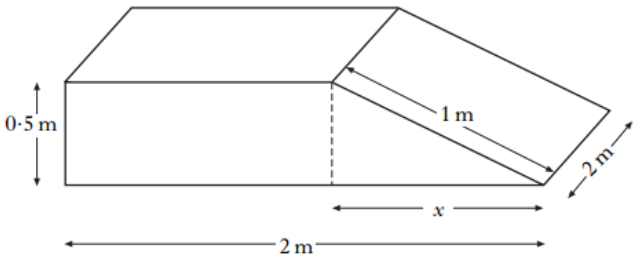
4. Calum sells storage boxes; he is paid a basic salary plus commission on his sales every month. Calculate his gross monthly pay if his basic wage is £450 per month plus 4% on sales of £20 000.

5. The diagram shows two storage jars which are mathematically similar.
   The volume of the large jar is 1.2 litres.



   Find the volume of the smaller jar.
   Give your answer **in litres correct to 2 significant figures.**

6. A concrete ramp is to be built.
   The ramp is in the shape of a cuboid and a triangular prism with dimensions as shown.



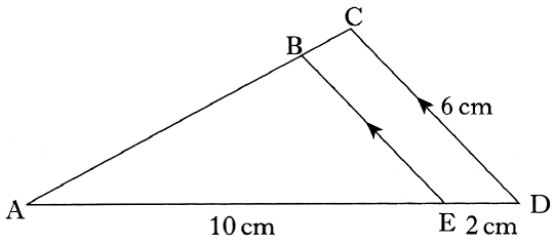
   (i) Calculate the value of x.
   (i) Calculate the volume of concrete required to build the ramp.
   (ii) Calculate the surface area of the ramp.

S3 Level 4 → N5 HOMEWORK EXERCISE No. 10

1. Multiply out the brackets and collect like terms

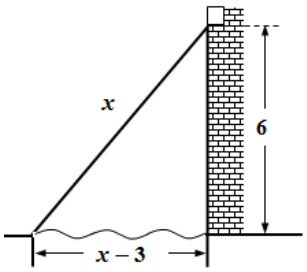
$$(2x + 3)(x^2 - 4x + 1) - (2x - 1)^2$$

2. Triangles ABE and ACD are similar.



Calculate the length of BE.

3. The King's Knights are attacking Baron Bracket's Castle.
The height of the window they want to reach is 6m from the ground.
The width of the moat is 3m less than the length of the ladder (xm), which just reaches the window.



Find the length of the ladder and the width of the moat.

4. Shampoo is available in travel size and salon size bottles.
The bottles are mathematically similar.

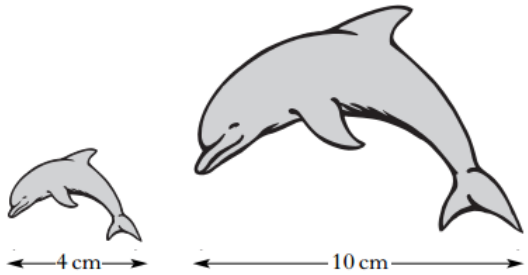
The travel size contains 200 millilitres and is 12 centimetres in height.
The salon size contains 1600 millilitres.
Calculate the **height** of the salon size bottle.

S3 Level 4 → N5 HOMEWORK EXERCISE No. 11

1. Solve these equations:

   (i) $3(x - 3) = \frac{1}{2}x + 7$ (ii) $(3x + 1)^2 = 9x^2 - 2$

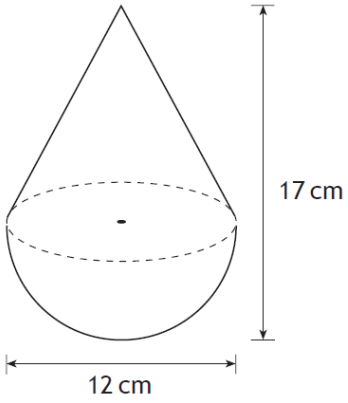
2. Two fridge magnets are mathematically similar.
   One magnet is 4 centimetres long and the other is 10 centimetres long.



   The area of the smaller magnet is 18 square centimetres.
   Calculate the area of the larger magnet.

3. Simplify $\frac{8xy^2}{16x^2y}$

4. A toy is in the shape of a hemisphere with a cone on top, as shown in the diagram,



   The toy is 12 centimetres wide and 17 centimetres high.
   Calculate the volume of the toy.
   Give your answer correct to 2 significant figures.

5. The waiting times for taxis from a particular company are given below.

0	8	9				
1	2	4	5	5	8	
2	0	0	1	3	9	n = 17
3	2	4	5			
4	1	3				1 | 3 represents 13

   For the given data, calculate
   (i) the median
   (ii) the semi-interquartile range (SIQR)

S3 Level 4 → N5 HOMEWORK EXERCISE No. 12

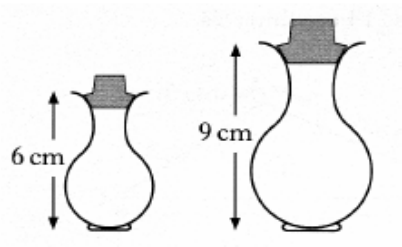
1. Calculate the **compound interest** earned when £50 000 is invested for 4 years at 4.5% per annum.
   Give your answer to the nearest penny.

2. Evaluate $\frac{3}{8}$ **of** $\left(1\frac{2}{3}-\frac{4}{7}\right)$ **without** a calculator, showing all working.

3. The planet Mars is at a distance of 2.3×10^8 kilometres from the Sun.
   The speed of light is 3.0×10^5 km per second.
   How long does it take light from the Sun to reach Mars?
   Give your answer to the nearest minute.

4. Factorise the following expressions

   i) $3x^2 - 6x$ ii) $9y^2 - 16$ iii) $x^2 - 4x + 3$ iv) $3x^2 + 7x - 6$

5. 

   Two perfume bottles are mathematically similar in shape.

   The smaller one is 6 centimetres high and holds 30 millilitres of perfume.
   The larger one is 9 centimetres high.
   What volume of perfume will the larger one hold?

6. The Battle of Largs in 1263 is commemorated by a monument known as The Pencil.

   This monument is in the shape of a cylinder with a cone on top.

   The cylinder part has diameter 3 metres and height 15 metres.

   (i) Calculate the volume of the **cylinder** part of The Pencil.

   The volume of the **cone** part of The Pencil is 5.7 cubic metres.

   (ii) Calculate the **total** height of The Pencil.

S3 Level 4 → N5 HOMEWORK EXERCISE No. 13

1. Factorise the following:

(i) $2a^2 + 6a$ (ii) $9xb^2 - 3b$ (iii) $c^2 + 15c + 26$

(iv) $5d^2 - 8d - 4$ (v) $12e^2 + 7e - 12$ (vi) $4f^2 - 49g^2$

2. A sphere has a diameter of 6 centimetres.
Calculate **without a calculator** its volume.
Take $\pi = 3.14$.

3. The score achieved by two darts players on their first 9 darts are shown below.

Player 1: 60, 57, 41, 3, 41, 80, 120, 81, 7

Player 2: 121, 125, 22, 98, 25, 37, 60, 60, 22

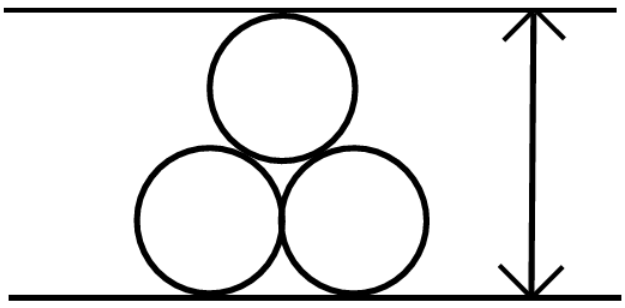
(i) Calculate the quartiles and median for each darts player.
(ii) Calculate the semi-interquartile range for both players.
(iii)Which darts player performed better? Justify your answer.

4. Sam's gross wage is £56 000 per annum and his tax code is 470L. Using the table below, calculate his personal allowance and annual tax bill for 2013-14.

Income Tax rates and taxable bands

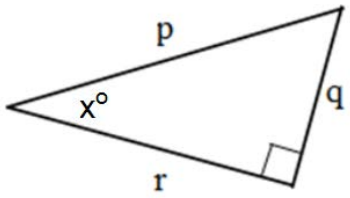
Rate	2011-12	2012-13	2013-14
Starting rate for savings: 10%*	£0 - £2,560	£0-£2,710	£0- £2,790
Basic rate: 20%	£0 - £35,000	£0-£34,370	£0-£32,010
Higher rate: 40%	£35,001 - £150,000	£34,371- £150,000	£32,011- £150,000
Additional rate: 50%	Over £150,000	Over £150,000	N/A
Additional rate: 45% from 6 April 2013	N/A	N/A	Over £150,000

5. Find the total height of the following stack of touching circles, each with a radius of 5 units.



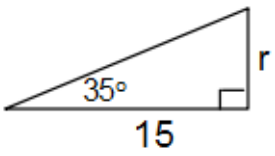
S3 Level 4 → N5 HOMEWORK EXERCISE No. 14

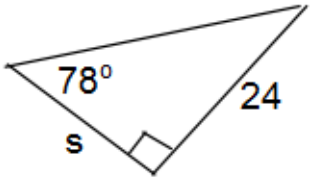
1. Write down the value of tan $x°$ for the triangle opposite.



2. If tan $y° = 2.5$, find the size of angle y, correct to one decimal place.

3. Calculate the length of r and s correct to 3 significant figure.





4. Factorise the following <u>fully</u>:

   (i) $ay + by$ (ii) $p^2 - q^2$ (iii) $x^2 - 7x + 10$ (iv) $2f^2 + 8f + 6$

5. The tyre pressure (in grams per square millimetre) of a heavy lorry are checked and found to be:

   59, 51, 56, 63, 51, 62, 66, 63, 60, 48 63, 55.

   (i) Calculate the median, lower and upper quartiles.
   (ii) Construct a box plot to illustrate the figures.
   (iii) Calculate the semi-interquartile range.

6. Solve these equations:

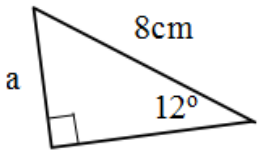
   (i) $5 - 3(x + 2) = 7x + 7$ (ii) $(x - 2)^2 = x(x + 1)$

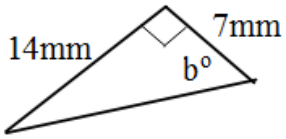
7. A farmer has enough feeding stuff for his 50 cattle to last 10 weeks. If he sells 10 of his cattle, how much longer will the feeding stuff last?

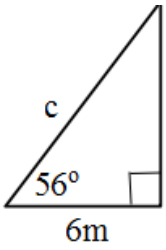
8. The area of a rhombus is 40 cm². If one of its diagonals is 8 cm long, calculate the length of a side of the rhombus correct to two decimal places. (Draw diagram!)

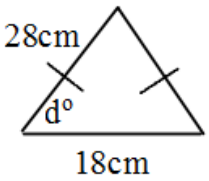
S3 Level 4 → N5 HOMEWORK EXERCISE No. 15

1. Find the missing side or angle a, b, c, d in each case:









Round all answers correctly to 3 significant figures.

2. By <u>drawing their graphs,</u> solve the following simultaneous equations:

(i) $x - 2y = 3$)
$x + y = 0$)

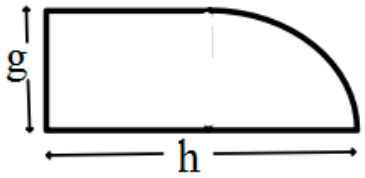
(ii) $x + 3y = 9$)
$2x - y = 4$)

3. Leisure centre records show that of the last 200 people to attend the centre:

70 came for the keep-fit facilities
30 came for the swimming
80 came for court games
20 came for dance lessons

(i) Find the fraction of the people who went to each activity
(ii) Draw a pie chart to show the use made of the leisure centre.
[Show full working!]

4. This shape consists of a rectangle and a quarter-circle.
Find a formula for its area in terms of
g, h and π. Answer in simplest form.



5. Simplify the following:

(i) $(2d^2)^3$ (ii) $3e^2 + e + \frac{4e^5}{e^3} - 2e$ (iii) $16f^2 \times \frac{f^{-3}}{4}$

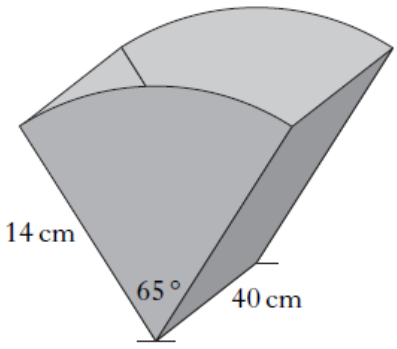
6.

The ends of a magazine rack are identical.

Each end is a sector of a circle with radius 14 centimetres.
The angle in each sector is 65 °.

The sectors are joined by two rectangles, each with length 40 centimetres.

The exterior is covered by material.
What area of material is required?



S3 Level 4 → N5 HOMEWORK EXERCISE No. 16

1. Solve the following simultaneous equations algebraically:

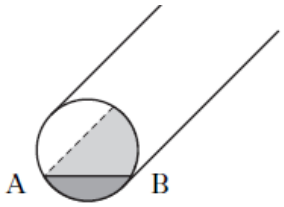
   (i) $3x - 8y = 11$)
   $-x + 8y = 7$)

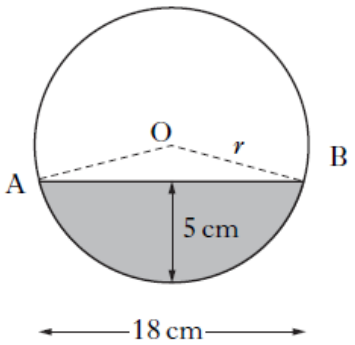
   (ii) $4x - 7y = -25$)
   $-2x + 5y = 17$)

2. A woman buys 6 oranges and 4 apples for £1.18 one week, and at the same prices, buys 4 oranges and 5 apples for 95p the following week.
   How much do apples and oranges cost each?

3. A bag contains a mixture of red, orange and yellow sweets.
   If the probability of selecting a red sweet at random is ½, and the probability of selecting an orange sweet is ⅓. What is P (selecting a yellow)?

4. A pipe has water in it as shown.





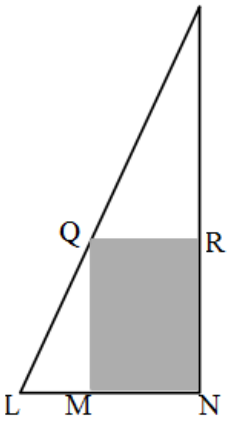
   The depth of water is 5cm and the width of the water surface, AB, is 18cm.
   Calculate ***r***, the radius of the pipe.

5. Factorise fully:

   (i) $x^2 + 3x - 28$ (ii) $ab^2x + a^2by$ (iii) $2x^2 - 50$

6. The figure shows a ladder LP leaning against a wall NP touching the corner to a rectangular shed at Q.

   (i) Name three similar triangles in the diagram.
   (ii) If LM = 1m, MN = 2m and MQ = 4m, calculate how far up the wall the ladder reaches.



7. When the sun is shining at an angle of 14° to the horizontal, calculate the length of the shadow cast by a building which is 36 metres high.