2500/405

MATHEMATICS
STANDARD GRADE
Credit Level
Paper 1
(Non-calculator)

1 **You may NOT use a calculator**.

2 Answer as many questions as you can.

3 Full credit will be given only where the solution contains appropriate working.

4 Square-ruled paper is provided.

SQA

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: Area $= \frac{1}{2}ab \sin C$

Standard deviation: $s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, where n is the sample size.

1. Evaluate

$$(846 \div 30) - 1{\cdot}09.$$

2. Evaluate

$$4\frac{1}{3} - 1\frac{1}{2}\ .$$

3. Given that

$$f(x) = x^2 + 3,$$

(*a*) evaluate $f(-4)$

(*b*) find t when $f(t) = 52$.

4. (*a*) Factorise

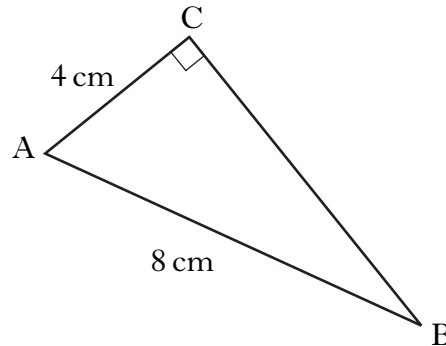$$x^2 - 4y^2.$$

(*b*) Expand and simplify

$$(2x - 1)(x + 4).$$

(*c*) Expand

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

[Turn over

5. In triangle ABC:

- angle ACB = 90°
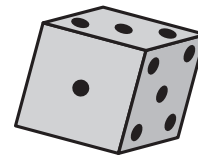- AB = 8 centimetres
- AC = 4 centimetres.

Calculate the length of BC.

Give your answer **as a surd in its simplest form**.

3

6. There are 4 girls and 14 boys in a class.

A child is chosen at random and is asked to roll a die, numbered 1 to 6.

Which of these is more likely?

    A: the child is female.

       OR

    B: the child rolls a 5.

Justify your answer.

3

7. This year, Ben paid £260 for his car insurance.

This is an increase of 30% on last year's payment.

How much did Ben pay last year?

3

8. In triangle PQR:

    - PQ = x centimetres
    - PR = $5x$ centimetres
    - QR = $2y$ centimetres.

(a) The perimeter of the triangle is 42 centimetres.

Write down an equation in x and y to illustrate this information.

2

(b) PR is 2 centimetres longer than QR.

Write down another equation in x and y to illustrate this information.

2

(c) Hence calculate the values of x and y.

3

9. A formula used to calculate the flow of water in a pipe is

$$f = \frac{kd^2}{20}.$$

Change the subject of the formula to d.

3

[Turn over

10. The diagram below shows the path of a rocket which is fired into the air.

The height, *h* metres, of the rocket after *t* seconds is given by
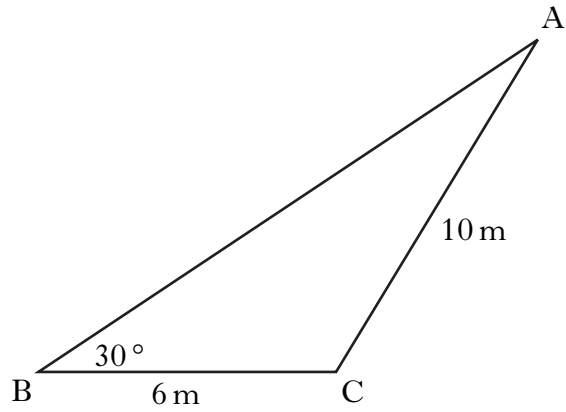
$$h(t) = -2t(t - 14).$$
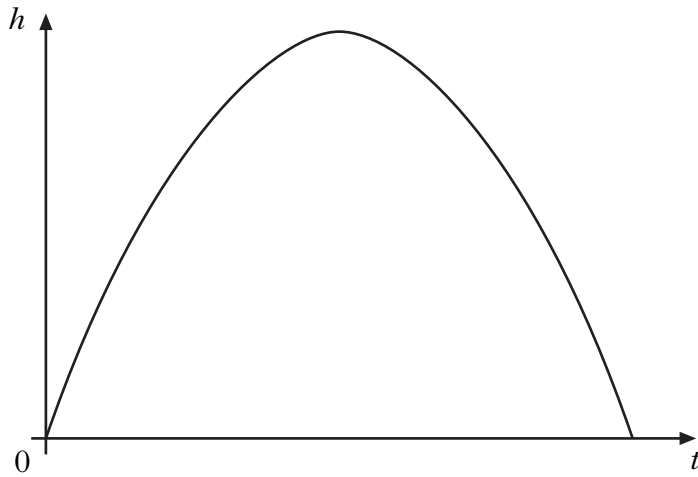
(*a*) For how many seconds is the rocket in flight?

2

(*b*) What is the maximum height reached by the rocket?

2

11. In triangle ABC:

- BC = 6 metres

- AC = 10 metres

- angle ABC = 30°.

Given that sin 30° = 0·5, show that sin A = 0·3.

3

[END OF QUESTION PAPER]

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2500/406

WEDNESDAY, 6 MAY 2.45 PM – 4.05 PM

MATHEMATICS
STANDARD GRADE
Credit Level
Paper 2

1 **You may use a calculator**.

2 Answer as many questions as you can.

3 Full credit will be given only where the solution contains appropriate working.

4 Square-ruled paper is provided.

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{\left(b^2 - 4ac\right)}}{2a}$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: Area $= \frac{1}{2} ab \sin C$

Standard deviation: $s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, where n is the sample size.

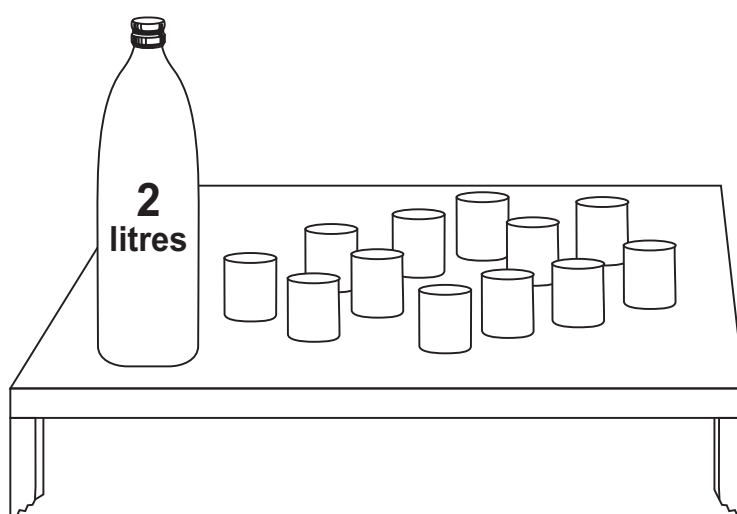**1.** One atom of gold weighs $3 \cdot 27 \times 10^{-22}$ grams.

How many atoms will there be in one kilogram of gold?

Give your answer **in scientific notation correct to 2 significant figures**.

2. Lemonade is to be poured from a 2 litre bottle into glasses.

Each glass is in the shape of a cylinder of radius 3 centimetres and height 8 centimetres.

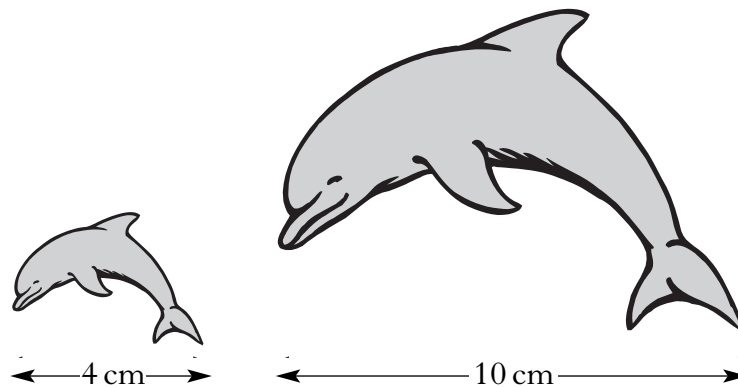How many full glasses can be poured from the bottle?

3. Solve the quadratic equation $x^2 - 4x - 6 = 0$.

Give your answers **correct to 1 decimal place**.

[Turn over

4. Two fridge magnets are mathematically similar.

One magnet is 4 centimetres long and the other is 10 centimetres long.

←—4 cm—→   ←————10 cm————→

The area of the smaller magnet is 18 square centimetres.

Calculate the area of the larger magnet.

3

5. Tom looked at the cost of 10 different flights to New York.

He calculated that the mean cost was £360 and the standard deviation was £74.

A tax of £12 is then added to each flight

Write down the new mean and standard deviation.

2

6. Teams in a quiz answer questions on film and sport.

This scatter graph shows the scores of some of the teams.
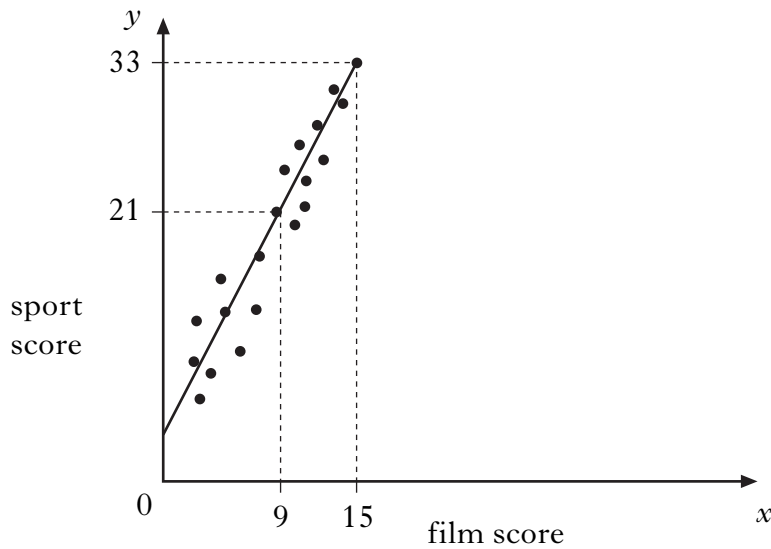
A line of best fit is drawn as shown above.

(*a*) Find the equation of this straight line.

(*b*) Use this equation to estimate the sport score for a team with a film score of 20.

7. (*a*) The air temperature, $t°$ Celsius, varies inversely as the square of the distance, d metres, from a furnace.

Write down a formula connecting t and d.

(*b*) At a distance of 2 metres from the furnace, the air temperature is $50°C$.

Calculate the air temperature at a distance of 5 metres from the furnace.

[Turn over

8. A company makes large bags of crisps which contain 90 grams of fat.

The company aims to reduce the fat content of the crisps by 50%.

They decide to reduce the fat content by 20% each year.

Will they have achieved their aim by the end of the 3rd year?

Justify your answer.

9. Jane is taking part in an orienteering competition.
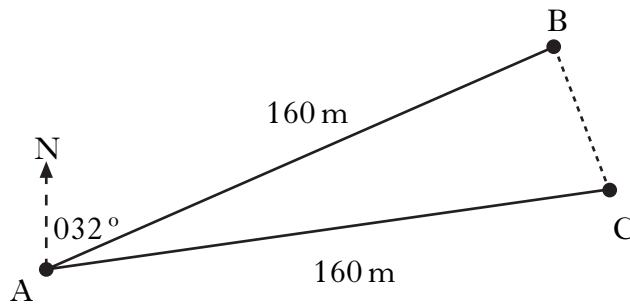
She should have run 160 metres from A to B on a bearing of 032°.

However, she actually ran 160 metres from A to C on a bearing of 052°.

(*a*) Write down the size of angle BAC.

(*b*) Calculate the length of BC.

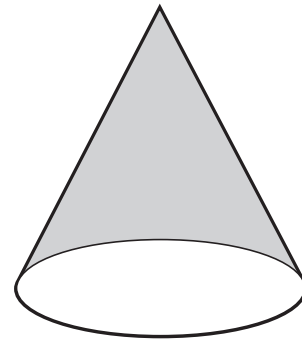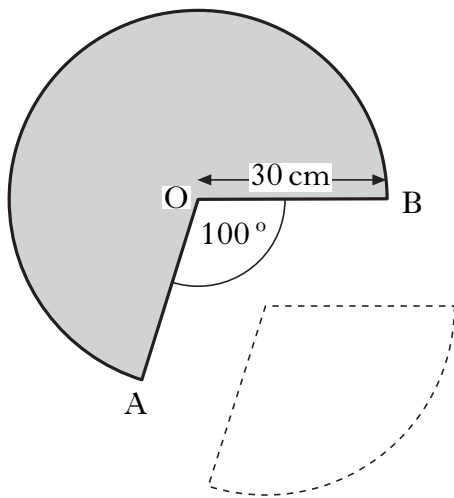(*c*) What is the bearing from C to B?

10. The weight, W kilograms, of a giraffe is related to its age, M months, by the formula

$$W = \tfrac{1}{4}\left(M^2 - 4M + 272\right).$$

At what age will a giraffe weigh 83 kilograms?

4

11. A cone is formed from a paper circle with a sector removed as shown.

The radius of the paper circle is 30 cm.

Angle AOB is 100°.

(*a*) Calculate the area of paper used to make the cone.

3

(*b*) Calculate the circumference of the base of the cone.

3

[Turn over for Question 12 on *Page eight*

12. The nth term, T_n of the sequence 1, 3, 6, 10, . . . is given by the formula:

$$T_n = \tfrac{1}{2}n(n+1)$$

1st term $\quad T_1 = \tfrac{1}{2} \times 1(1+1) = 1$

2nd term $\quad T_2 = \tfrac{1}{2} \times 2(2+1) = 3$

3rd term $\quad T_3 = \tfrac{1}{2} \times 3(3+1) = 6$

(*a*) Calculate the 20th term, T_{20}.

1

(*b*) Show that $\quad T_{n+1} = \tfrac{1}{2}\left(n^2 + 3n + 2\right)$.

2

(*c*) Show that $T_n + T_{n+1}$ is a square number.

2

[END OF QUESTION PAPER]