

**2500/406**

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NATIONAL  
QUALIFICATIONS  
2009WEDNESDAY, 6 MAY  
2.45 PM – 4.05 PMMATHEMATICS  
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  $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

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

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

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

1. One atom of gold weighs  $3.27 \times 10^{-22}$  grams.

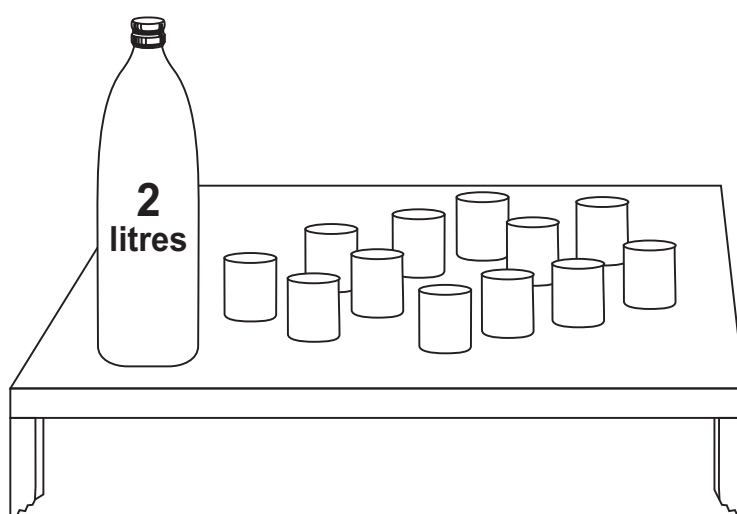
How many atoms will there be in one kilogram of gold?

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

3

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?

4

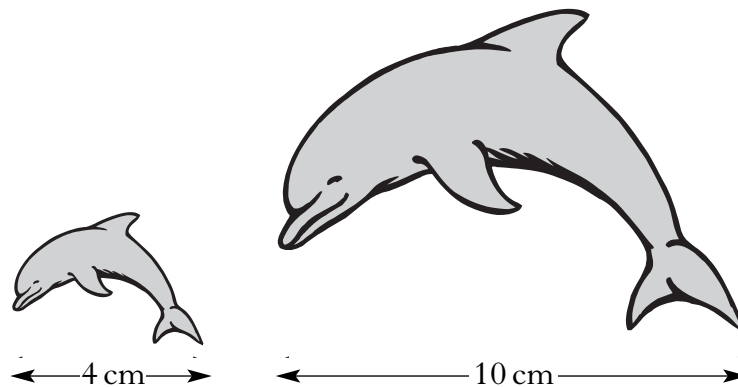
3. Solve the quadratic equation  $x^2 - 4x - 6 = 0$ .

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

4

[Turn over

4. 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.

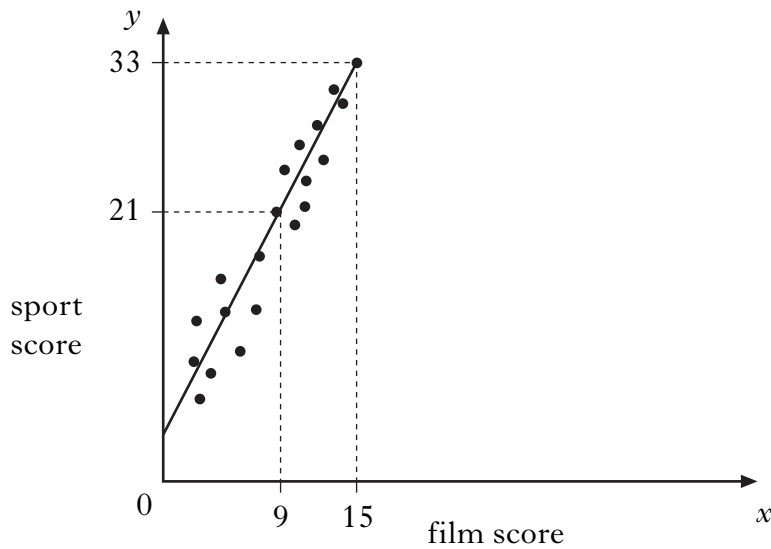
3

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.

4

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2

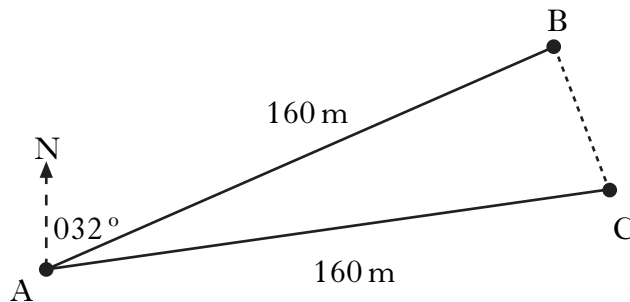
3

[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.**

4

9. Jane is taking part in an orienteering competition.



She should have run 160 metres from A to B on a bearing of  $032^\circ$ . However, she actually ran 160 metres from A to C on a bearing of  $052^\circ$ .

- (a) Write down the size of angle BAC.  
 (b) Calculate the length of BC.  
 (c) What is the bearing from C to B?

1

3

2

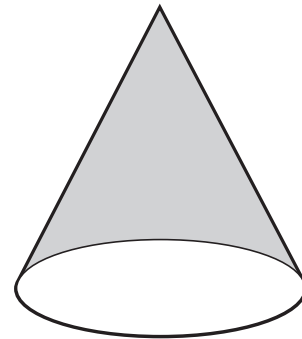
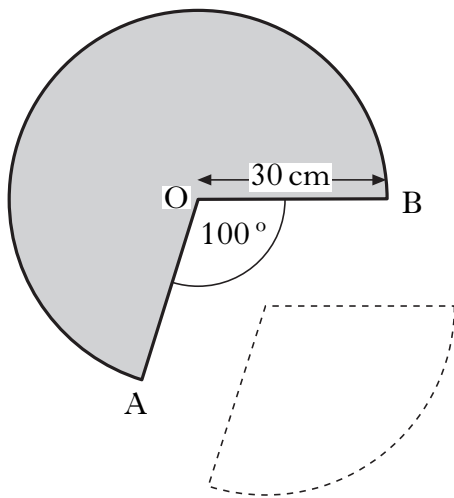
10. The weight,  $W$  kilograms, of a giraffe is related to its age,  $M$  months, by the formula

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

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  $100^\circ$ .



- (a) Calculate the area of paper used to make the cone.  
 (b) Calculate the circumference of the base of the cone.

3

3

[Turn over for Question 12 on Page eight

