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2500/406

NATIONAL QUALIFICATIONS 2009

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

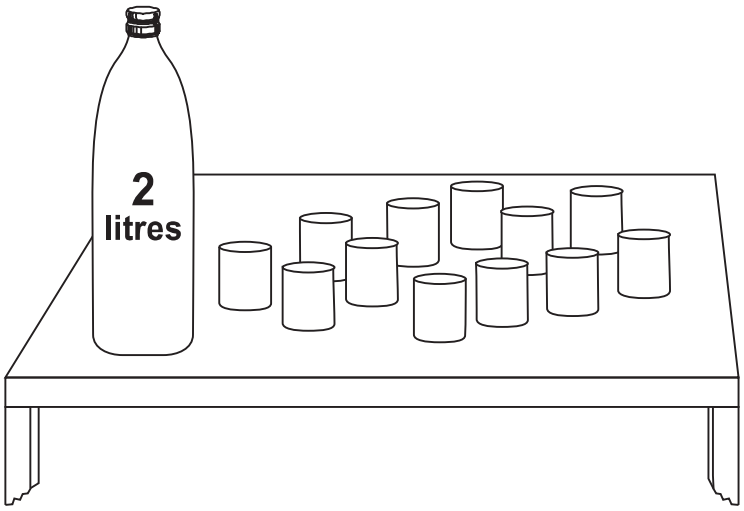
The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{\left(b^2 - 4ac\right)}}{2a}$

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

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

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

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.

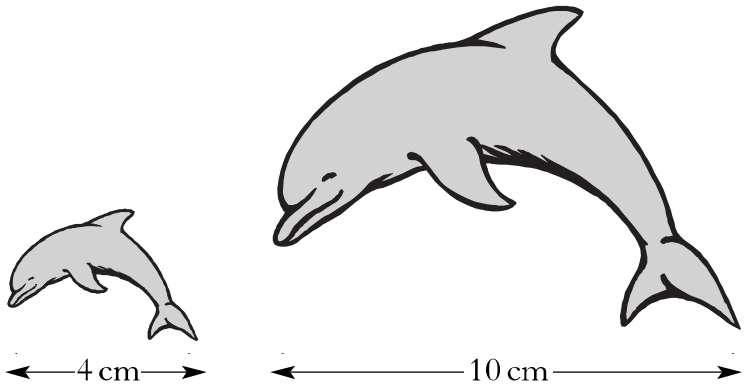
	KU	RE
1. One atom of gold weighs $3{\cdot}27 \times 10^{-22}$ grams. How many atoms will there be in one kilogram of gold? Give your answer **in scientific notation correct to 2 significant figures**.	**3**	
2. Lemonade is to be poured from a 2 litre bottle into glasses. Each glass is in the shape of 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

	KU	RE

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.

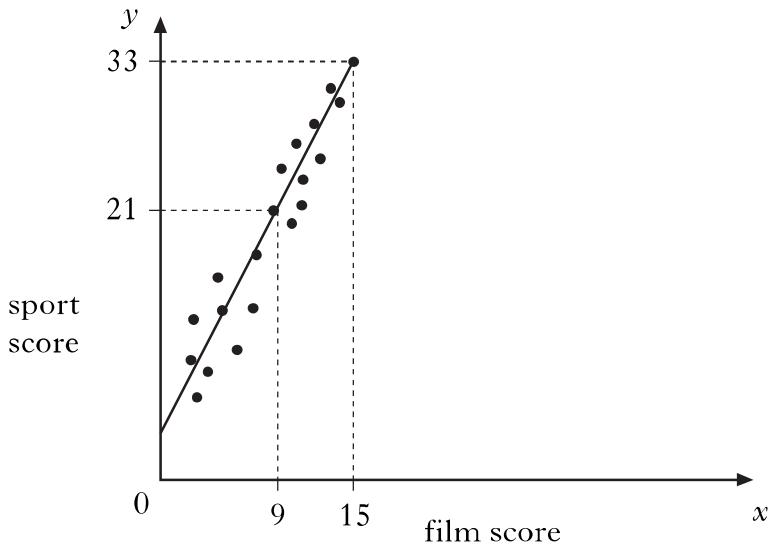
A tax of £12 is then added to each flight

Write down the new mean and standard deviation. **2**

	KU	RE

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. **4**

(*b*) Use this equation to estimate the sport score for a team with a film score of 20. **2**

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

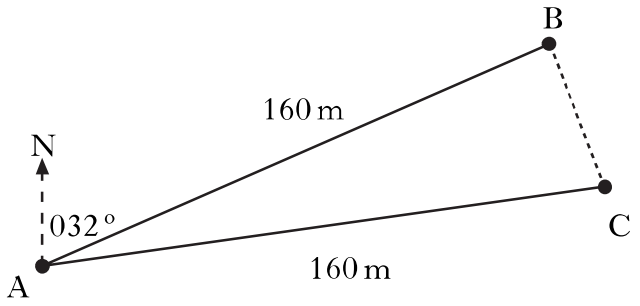
Write down a formula connecting t and d. **2**

(*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. **3**

[Turn over

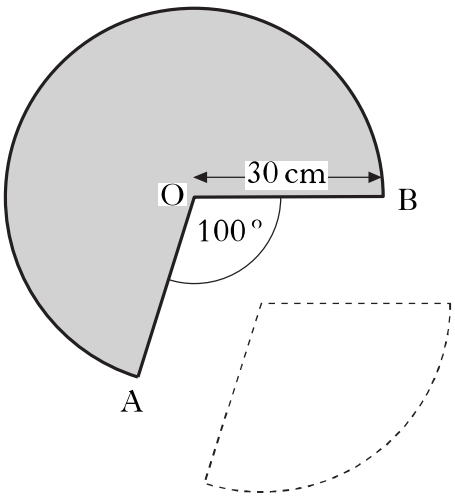
	KU	RE
8. A company makes large bags of crisps which contain 90 grams of fat. The company aims to reduce the fat content of the crisps by 50%. They decide to reduce the fat content by 20% each year. Will they have achieved their aim by the end of the 3rd year? **Justify your answer.**		**4**
9. Jane is taking part in an orienteering competition.		

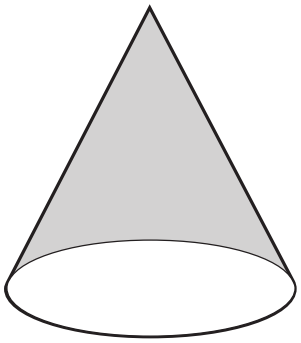


She should have run 160 metres from A to B on a bearing of 032°.
However, she actually ran 160 metres from A to C on a bearing of 052°.

(*a*) Write down the size of angle BAC.	**1**	
(*b*) Calculate the length of BC.		**3**
(*c*) What is the bearing from C to B?		**2**

	KU	RE
10. The weight, W kilograms, of a giraffe is related to its age, M months, by the formula $W = \frac{1}{4}\left(M^2 - 4M + 272\right)$. 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*

	KU	RE

12. The n^{th} term, T_n of the sequence 1, 3, 6, 10, . . . is given by the formula:

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

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

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

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

(*a*) Calculate the 20^{th} term, T_{20}. **1**

(*b*) Show that $T_{n+1} = \frac{1}{2}(n^2+3n+2)$. **2**

(*c*) Show that $T_n + T_{n+1}$ is a square number. **2**

[*END OF QUESTION PAPER*]