KULLEĠĠ SAN BENEDITTU
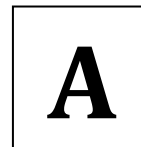
Boys Secondary School, Kirkop

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HALF-YEARLY EXAMINATIONS – FEBRUARY 2014

FORM 4   **MATHEMATICS** Scheme A   **TIME: 1hr 40mins**

Main Paper

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Main	NC	Global Mark
Mark																	

DO NOT WRITE ABOVE THIS LINE

NAME AND SURNAME:_____   CLASS:_____

<u>INSTRUCTIONS TO CANDIDATES</u>:

Read all the questions carefully before you start answering.

- Answer all questions.
- This paper carries 80 marks.
- Calculators and mathematical instruments are allowed but all necessary working must be shown.

1. Simplify the following giving your answer as a single power (in the form of a^n):

a) $\dfrac{3^6}{3}$

b) $\dfrac{\left(9^5\right)^2}{9^0}$

c) $\dfrac{2^6}{8}$

_____   _____   _____

(4 marks)

2. The mean distance of the earth from the sun is **149.6 million** kilometres.

   a) Write the number 149.6 million in **standard form**.

   _____ km

   The earth travels a distance of *D* km in one day.
   The value of *D* is given by the formula:
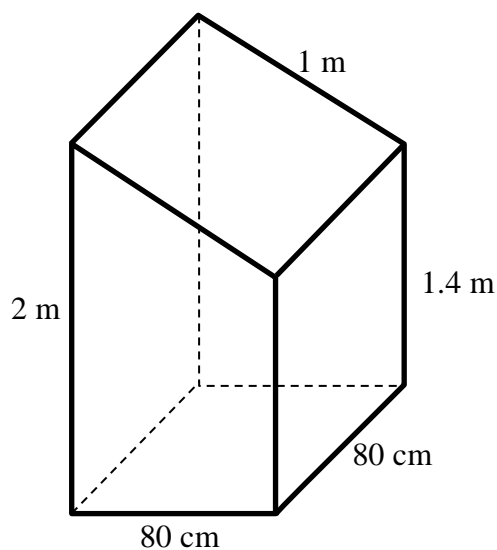
   $$D = \frac{2\pi \times \text{distance of earth from sun}}{365}$$

   b) Calculate the value of *D* giving your answer in **standard form** correct to **3 significant figures**.

   _____ km

   (4 marks)

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3. The diagram shows a sketch of a monument, which is to be covered in marble. Calculate the area, in m^2, of marble required to cover all the sides and slanting top of the monument.

   _____ m^2

   (4 marks)

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4. a) By selling a particular set of books for €408, a bookseller makes a loss of 4%. Find the cost price of the books.

€_____

b) The population of the world was estimated to be 4.5×10^9 at the beginning of 1990. If the population increases by 3% each year, find the population

   i) at the beginning of 1991.

_____

   ii) at the beginning of the year 2000, correct to **1 significant figure** and in **standard form.**

_____

(7 marks)

5. Express as simply as possible:

   a) $\dfrac{4x^2 \times 6x^5}{12x^3} =$

_____

   b) $\dfrac{a^4 \times \left(a^2\right)^2}{a^8} =$

_____

(5 marks)

6. Jim borrows €2000 to furnish a new flat. He has to pay interest at the rate of 15% per annum.

    (a) Find the amount of interest to be paid at the end of the first year.

    € _____

    He actually pays €500 back at the end of each year as a repayment. Jim uses a spreadsheet to see how much money he still owes the bank at the end of each year.

	A	B	C	D	E
1	beginning of year 1	balance	2000		
2					
3		balance + interest	2300		
4		repayment		500	
5	end of year 1	amount due	1800		
6					
7		balance + interest	2070		
8		repayment		500	
9	end of year 2	amount due	1570		
10					
11		balance + interest			
12		repayment			
13	end of year 3	amount due			
14					
15		balance +interest			
16		repayment			
17	end of year 4	amount due			
18					

    (b) What formula does Jim input in cell C11?

    = _____

    (c) Work out how much does he still owe at the end of the fourth year.
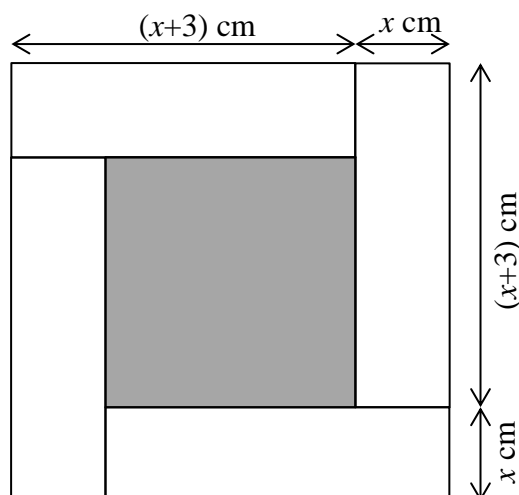
    € _____

    (6 marks)

7. Four identical rectangular tiles are placed around a square tile as shown in the following diagram.

a) i) Form an expression for the area of one rectangular tile.

_____

ii) Hence write an expression for the total area of the **four** rectangular tiles.

_____

The diagram shows dimensions $(x+3)$ cm and x cm along the top, $(x+3)$ cm and x cm along the right side.

b) Expand $(2x + 3)^2$

_____

c) **Hence or otherwise**, find the area of the shaded square in the middle.

_____ cm^2

(5 marks)

8. Express as a single fraction:
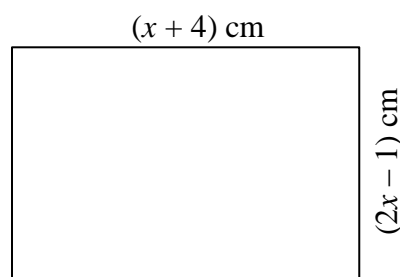
$$\frac{1}{3x} - \frac{2}{5y}$$

_____

(2 marks)

9. a) Solve: $2x^2 - 5x + 3 = 0$

$x =$ _____

b) The rectangle shown has a **length** of $(x+4)$ cm and a **width** of $(2x-1)$ cm.

Given that its area is 20 cm^2,

(i) show that $2x^2 + 7x - 24 = 0$

(x + 4) cm

(2x − 1) cm

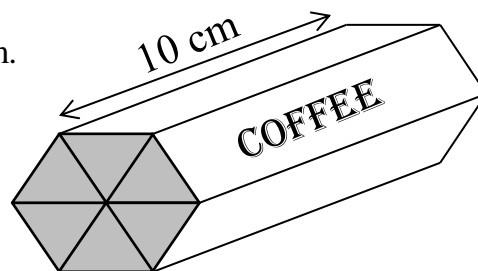(ii) Solve the equation to find the **length** of the rectangle to **2 decimal places**.

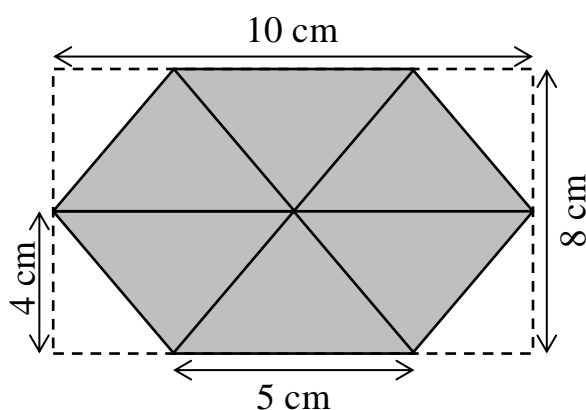_____ cm

(10 marks)

10. A coffee tin is in the shape of a hexagonal prism.
Its **length** is 10 cm long.

One end of the tin is shown below. Each of the six triangles in the hexagon has the same dimensions.

NOT
TO
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a) Calculate the total area of the hexagonal cross-section.

_____cm^2

Coffee fills 80% of the tin.
The mass of 1 cm^3 of coffee is 0.5 g .

b) Find the weight of coffee in the tin. Show all your working.

_____g

c) The same tin of coffee is sold at the price of €2.19. How much would you expect to pay for 100 g of this brand of coffee?

€_____

(8 marks)

11.   Students conduct an experiment to find **g**, the acceleration due to gravity.
       They measure the time, **T** seconds, for one complete swing of the pendulum of
       length **L** metres.

       The formula used to find **g** is:

$$g = \frac{4\pi^2 L}{T^2}$$

   a)   Find **g** when **L** = 0.3924 and **T** = 1.26, correct to **3 significant figures**.
         (use the **π** button on your calculator)

                                                                    g = _____

   b)   Rearrange the formula to express **T** in terms of **g**, **π** and **L**.
         Simplify your answer as far as possible.

                                                                    T = _____

                                                                        (5 marks)

___

12.   Find the value of *n*:

   a) $5^n = \frac{1}{125}$ b) $2 \times 4^n = 32$

                n = _____   *n* = _____

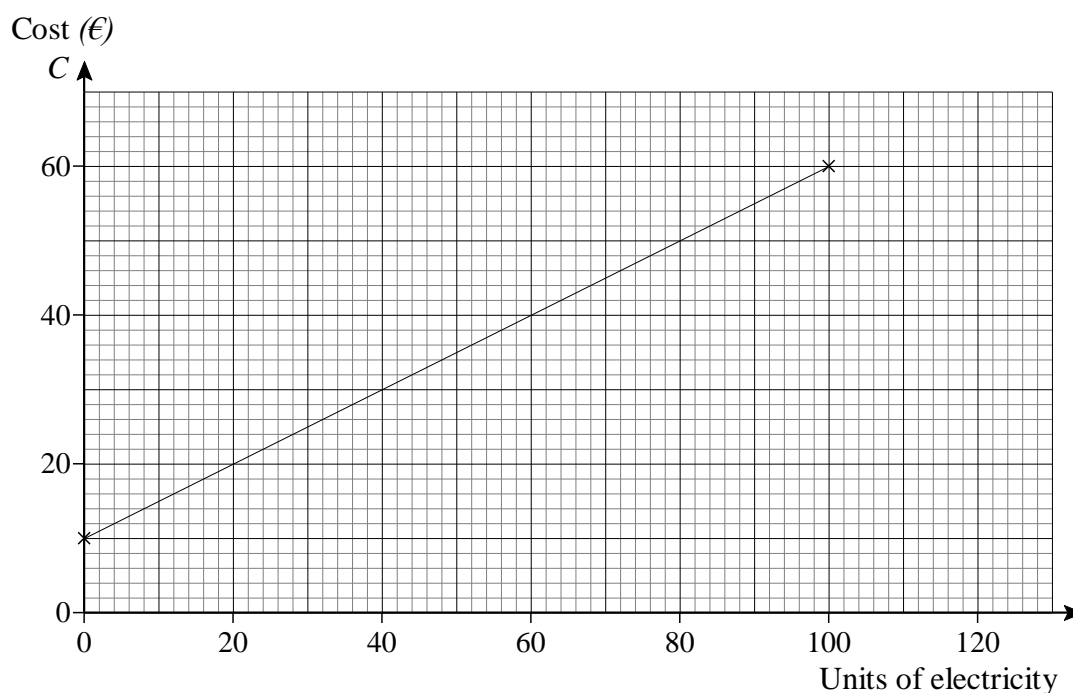   *(5 marks)*

___

13. The graph shows the cost *C*, in Euro, of electricity used by one person.

This cost C is made up from a fixed charge, plus the cost of the number of units of electricity used.

Cost *(€)*

a) Use the graph to find:

i) The fixed charge

€_____

ii) The cost, in cents, of one unit of energy

€_____

The same energy company, decides to eliminate the fixed charge. However, the price of one unit of energy is increased to 70 cents per unit.

b) By drawing another line (on the same graph) for the new rate, give the point of intersection of the two lines.

_____

c) A customer thinks that the second tarrif is cheaper. Explain, by making reference to the graphs) why this is not always the case.

(6 marks)

14. Kim went out for a trip on a Sunday afternoon.
She walked the first part of her journey at a **speed** of **6 km/hr** and ran the second part of the journey at **12 km/hr**.

The **total distance** travelled was 7 km.
The diagram below shows the distances covered during the whole trip.
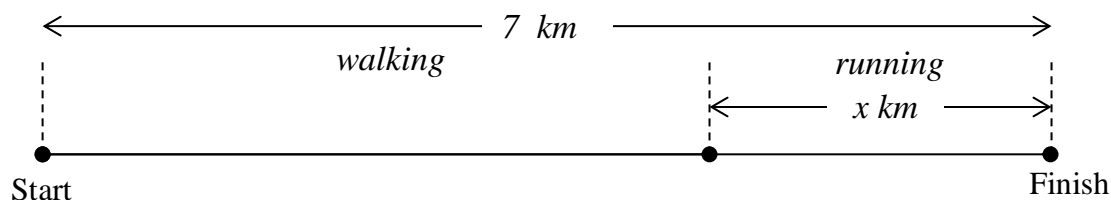
Given that the running distance was *x* km,

a) Write an expression in terms of *x* for the **distance** travelled while **walking**.

_____

b) Write an expression in terms of *x* for the **time** taken when **running**.

$$\left(\text{Speed} = \frac{\text{distance}}{\text{time}}\right)$$

_____

c) Write an expression in terms of *x* for the **time** taken when **walking**.

_____

If the **total time taken** for the whole journey was 1 hour,

d) Write down an equation in terms of *x*.

_____

e) Hence, **solve** the equation to find the distance covered while running.

x = _____

(9 marks)