LRN International GCSE: Mathematics (7131)

Candidate Name	
Candidate Number	
Centre Name	
Centre Number	

Paper 2: Mathematics **For Examination December 2023**

(2 hours 30 minutes)

It is necessary to respond on this question paper. You must have a soft pencil (preferably of type B or HB), a clean eraser and a dark blue or black pen.

INSTRUCTIONS:

- You must write your name, candidate number, centre name and centre number in the designated spaces.
- Attempt all the questions using a dark blue or black pen.
- You may use a soft pencil for graphs.
- If working is needed for any question, it must be shown below that question.
- Do not use correction fluid.
- Avoid writing on any bar codes.
- You are allowed to use a calculator, protractor and ruler if needed.

INFORMATION:

- This paper has a total of 100 marks.
- The number of marks assigned for every question, or its parts is indicated within brackets [].
- Rough work must be completed on this question paper.

1   Dhanu has a model railway.

(a)   He has a train that consists of a locomotive and 4 coaches.

The mass of the locomotive is 87 g and the mass of each coach is 52 g.

(i)   Work out the total mass of the train.

.... g [2]

(ii)   Work out the mass of the locomotive as a percentage of the total mass of the train.

.... % [1]

(b)   The train is 61 cm long and travels at a speed of 18 cm/s.

It takes 4 seconds for the whole of the train to cross a bridge.

Calculate the length of the bridge.

.... cm [2]

(c) A new locomotive costs $64.

Calculate the cost of the locomotive in rupees when the exchange rate is 1 rupee = $0.0154 . Give your answer correct to the nearest 10 rupees.

.... rupees [2]

(d) The cost of a railway magazine increases by 12.5% to $2.70 . Calculate

the cost of the magazine before this increase.

$ .... [2]

(e) Dhanu plays with his model railway from 06 50 to 11:15. He then rides his bicycle for 3 hours.

Find the ratio   time playing with model railway : time riding bicycle.

Give your answer in its simplest form.

.... : .... [3]

(f) The value of Dhanu's model railway is $550.

This value increases exponentially at a rate of r % per year. At the
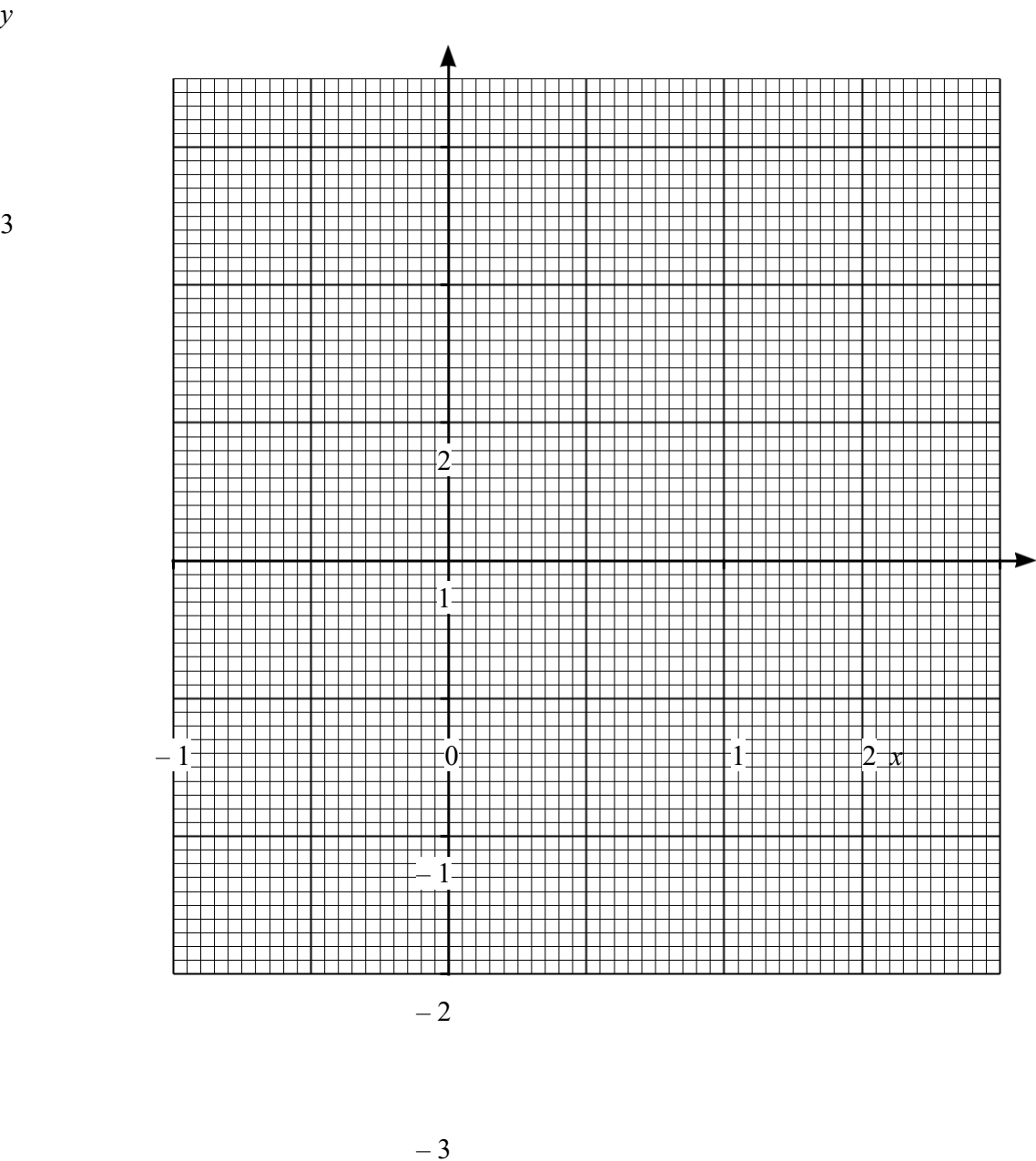end of 5 years the value will be $736.

Calculate the value of r.

$r =$ .... [3]

2 (a) The table shows some values for $y = 2x^3 - 4x^2 + 3$.

x	-1	- 0.5	0	0.5	1	1.5	2
y	-3	1.75				0.75	3

(i) Complete the table. [3]

(ii) On the grid, draw the graph of $y = 2x^3 - 4x^2 + 3$ for -1 G x G 2.

y

3

[4]

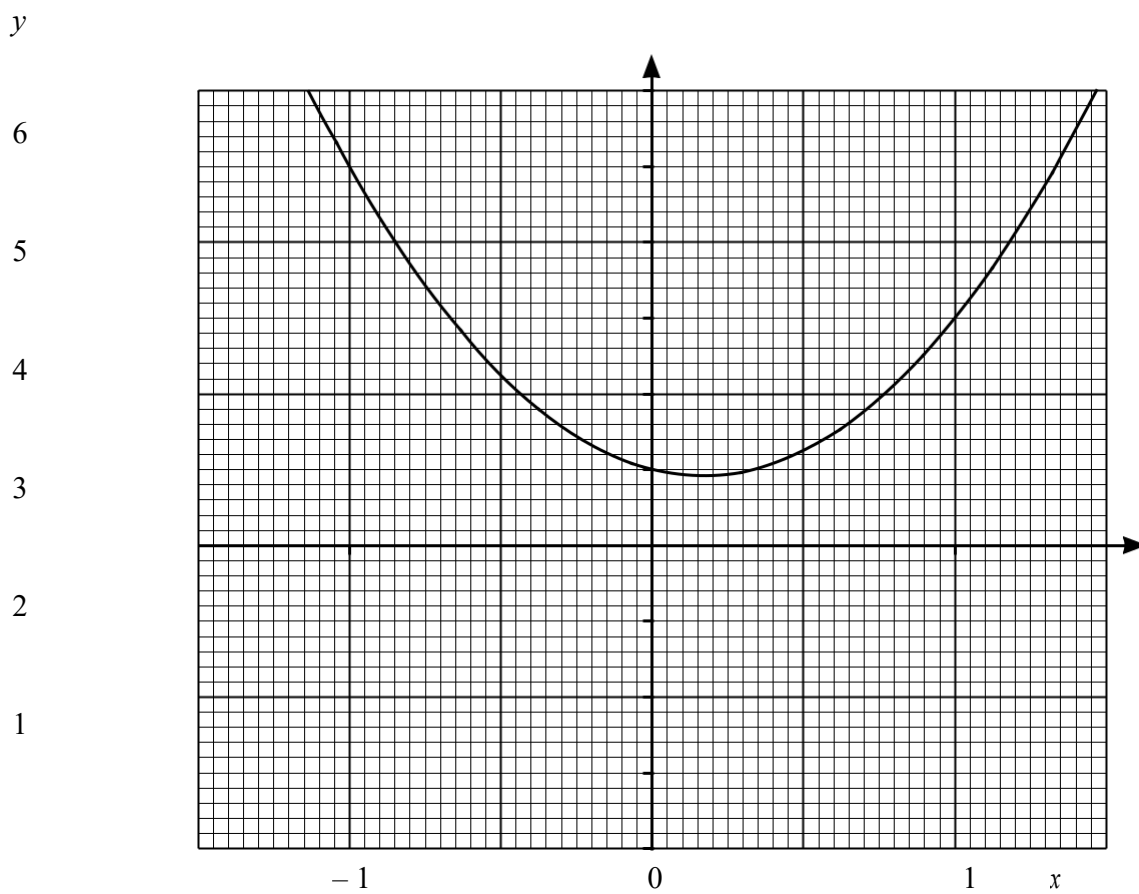**(iii)** Use your graph to solve the equation $2x^3 - 4x^2 + 3 = 1.5$.

$x =$ ....   or $x =$ ....   or $x =$ ....   [3]

(iv) The equation $2x^3 - 4x^2 + 3 = k$ has only one solution for $-1 \leq x \leq 2$. Write down a possible integer value of k.

.... [1]

(b)

y

(i) On the grid, draw the tangent to the curve at *x* = 1.   [1]

(ii) Use your tangent to estimate the gradient of the curve at *x* = 1.

.... [2]

(iii)   Write down the equation of your tangent in the form $y = mx + c$.

$y =$ .... [2]

3 **(a)** Manjeet uses 220 litres of water each day.

She reduces the amount of water she uses by 15%.

Calculate the number of litres of water she now uses each day.

.... litres [2]

(b) Manjeet has two mathematically similar bottles in her bathroom. The
large bottle holds 1.35 litres and is 29.7 cm high.
The small bottle holds 0.4 litres. Calculate the

height of the small bottle.

.... cm [3]

(c) Water from Manjeet's shower flows at a rate of 12 litres per minute.

The water from the shower flows into a tank that is a cuboid of length 90 cm and width 75 cm. Calculate the

increase in the level of water in the tank when the shower is used for 7 minutes.

.... cm [3]

4   A solid metal cone has radius 1.65 cm and slant height 4.70 cm.

(a) Calculate the **total** surface area of the cone.

[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

.... cm^2 [2]

(b) Find the angle the slant height makes with the base of the cone.

.... [2]

(c) **(i)** Calculate the volume of the cone.
[The volume, V, of a cone with radius r and height h is $V = 1/3\pi r^2 h$]

.... cm^3 [4]

(ii) A metal sphere with radius 5 cm is melted down to make cones identical to this one.

Calculate the number of complete identical cones that are made. [The volume, V, of a sphere with radius r is $V = 4/3\pi\, r^3$]

.... [4]

5 **(a)** Write as a single fraction in its simplest form.

$$\frac{x+3}{x-3} - \frac{x-2}{x+2}$$

.... [4]

$$2^{12} \div 2^{\frac{k}{2}} = 32$$

(b)

Find the value of k.

$k = $ ....   [2]

(c) Expand and simplify.

$(y + 3)(y - 4)(2y - 1)$

.... [3]

(d) Make x the subject of the formula.

$$x = \frac{3 + x}{y}$$

$x = $ .... [3]

6   Suleika has six cards numbered 1 to 6.

1	2	3	4	5	6

(a)   She takes one card at random, records the number and replaces the card.

(i)   Write down the probability that the number is 5 or 6.

.... [1]

(ii)   Suleika does this 300 times.

Find how many times she expects the number 5 or 6.

.... [1]

(b)   Suleika takes two cards at random, without replacement.

(i)   Find the probability that the sum of the numbers on the two cards is 5.

.... [3]

(ii)   Find the probability that at least one of the numbers on the cards is a square number.

.... [3]

7 **(a)** Naga has n marbles.

Panav has three times as many marbles as Naga.

Naga loses 5 marbles and Panav buys 10 marbles.

Together they now have more than 105 marbles.

Write down and solve an inequality in n.

.... [3]

(b) y is inversely proportional to x^2. When x = 4, y = 7.5 .

Find y when x = 5.

$y =$ .... [3]

(c) Find the *n*th term of each sequence.

(i)   4   2   0   -2   -4   …

.... [2]

(ii)   1   7   17   31   49   …

.... [2]

8 This year, 40 students have each travelled by one or more of plane (P), train (T) or boat (B).

  7 have travelled only by plane.
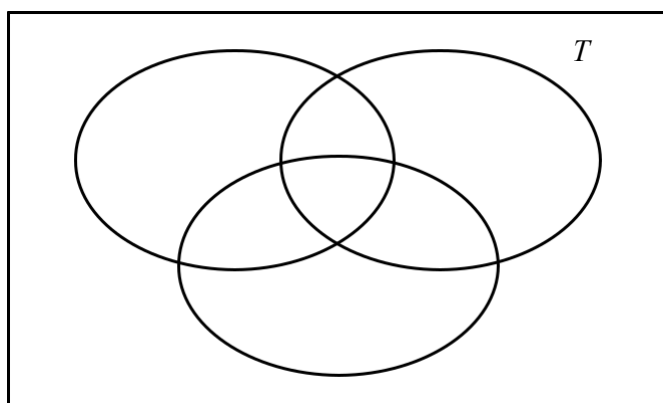
 11 have travelled only by train.

  9 have travelled only by boat.

   $n\,(P + T) = 8$

   $n\,(B + T) = 3$

   $n\,(B + P) = 6$

P T

B

   (a) Complete the Venn diagram. [3]

(b) Find

   $n\big((P \cup B)'\big)$.

.... [1]

9 $f(x) = 4x - 1$ $g(x) = x^2$ $h(x) = 3^{-x}$

(a) Find in its simplest form

(i) $f(x - 3)$,

.... [1]

(ii) $g(5x)$.

.... [1]

(b) Find $f^{-1}(x)$.

$f^{-1}(x) =$ .... [1]