TEMASEK JC INTEGRATED PROGRAMME
YEAR ONE
2021 END-OF-YEAR EXAMINATION

FUNDAMENTAL MATHEMATICS

Date: 8 October 2021
Duration: 2 hours

Name:	______________________
Class:	______________________

No additional materials required

READ THESE INSTRUCTIONS FIRST.

Write your answer in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Write your answers in the spaces provided in the question paper.

Additional writing materials can be used if there is insufficient space. These should be attached to the back of the booklet.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question. The calculator value for π should be used unless the question requires the answer in terms of π.
The use of an approved scientific calculator is expected where appropriate.

You are reminded of the need for clear presentation in your answers. Marks will be deducted for poor or unclear presentation.
The number of marks is given in brackets [ ] at the end of each question or part question.

The total score for this paper is 80 marks.

This paper consists of **16** printed pages, and no blank pages.

____
Parent's Signature

Question	Marks
1	
2	
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11	
12	
13	
Presentation Deduction	−1
Total	

Answer all questions in the spaces provided. Show all working clearly.

1 **(a)** Without the use of a calculator, evaluate $\frac{18}{-2^4} \times \left(1\frac{1}{3} - \frac{\sqrt[3]{-64}}{9}\right)$. [4]

(b) The table below shows the number of people and the respective entrance fees for a carnival on a specific day.

Age group	Number of people	Entrance Fee (per person)
Adult	18	\$14.15
Child	11	\$9.95

Without the use of a calculator, estimate the total amount collected on that day. [2]

2 **(i)** Find the HCF of 1 470 and 300. [3]

(ii) Paperclips are sold in packs of 1 470.
Thumbtacks are sold in packs of 300.
Beatrice buys the same number of paperclips as thumbtacks for her office.
Find the least number of packs of paperclips that she could have bought. [3]

3 **(a)** The numbers A, B and C, written as a product of their prime factors, are given below, where p, q and r are positive integers.

$A = p^2 \times q^7 \times r^{11}$

$B = p^4 \times q^2 \times r$

$C = 2 \times 7^3 \times 13^2$

Using the prime factors given above, find

(i) the cube root of $A \times B$, [2]

(ii) the smallest integer, k, such that $\frac{C}{k}$ is a perfect square. [1]

(b) The area of a square is $2\,601\ \text{cm}^2$. Using prime factorisation, find the perimeter of the square. [3]

4 **(a)** Expand and simplify $x + 4 + \frac{1}{2}(2y - 3x) - \frac{1}{6}(3x - 4y)$ completely. [3]

(b) Factorise $2p - q + (2p - q)(p - 3q) + (7p + 5q)(q - 2p)$ completely. [3]

5 **(a)** Solve the equation $\frac{3x+2}{2}-\frac{2-x}{6}=\frac{2x+3}{3}$. [4]

(b) Given that $\frac{p-3q}{2p-11q}=\frac{1}{5}$, find the value of $\frac{p}{q}$. [3]

6 Bruno has some money to buy textbooks and workbooks for the new school year.
If he buys x textbooks at \$12 each, he will have \$2 left.
If he buys $(x-2)$ workbooks at \$16 each, he will have \$6 left.

(i) Form an equation, in terms of x, and solve it to find the amount of money Bruno has. [4]

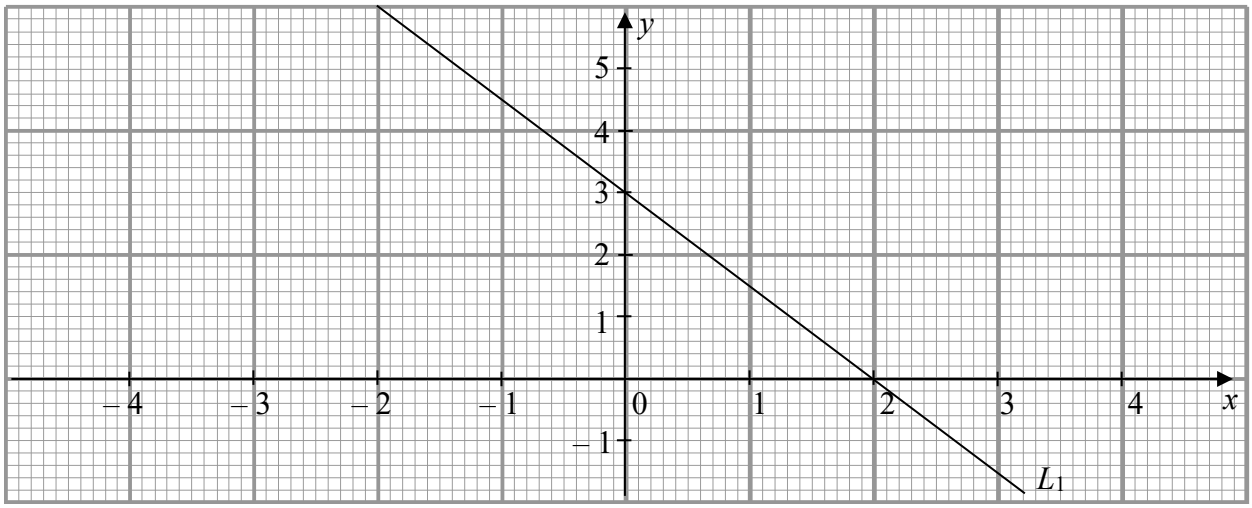
(ii) Bruno decides to buy 2 textbooks at \$12 each.
He uses the remaining money to buy workbooks at \$16 each.
How many workbooks can he buy? [3]

7 **(a)** Given that the exchange rate between the Singapore dollar (S\$) and the Canadian dollar (C\$) is S\$1 = C\$0.93, convert C\$10 000 into Singapore dollars. Leave your answer correct to the nearest cent. [2]

(b) A man deposited \$30 000 into a savings account that pays a simple interest of 2.2% per annum. Calculate the number of years required for the money in the account to exceed \$34 000. [4]

[Turn over

8 A straight line, L_1, is given in the grid below.



(i) Find the equation of the straight line L_1. [2]

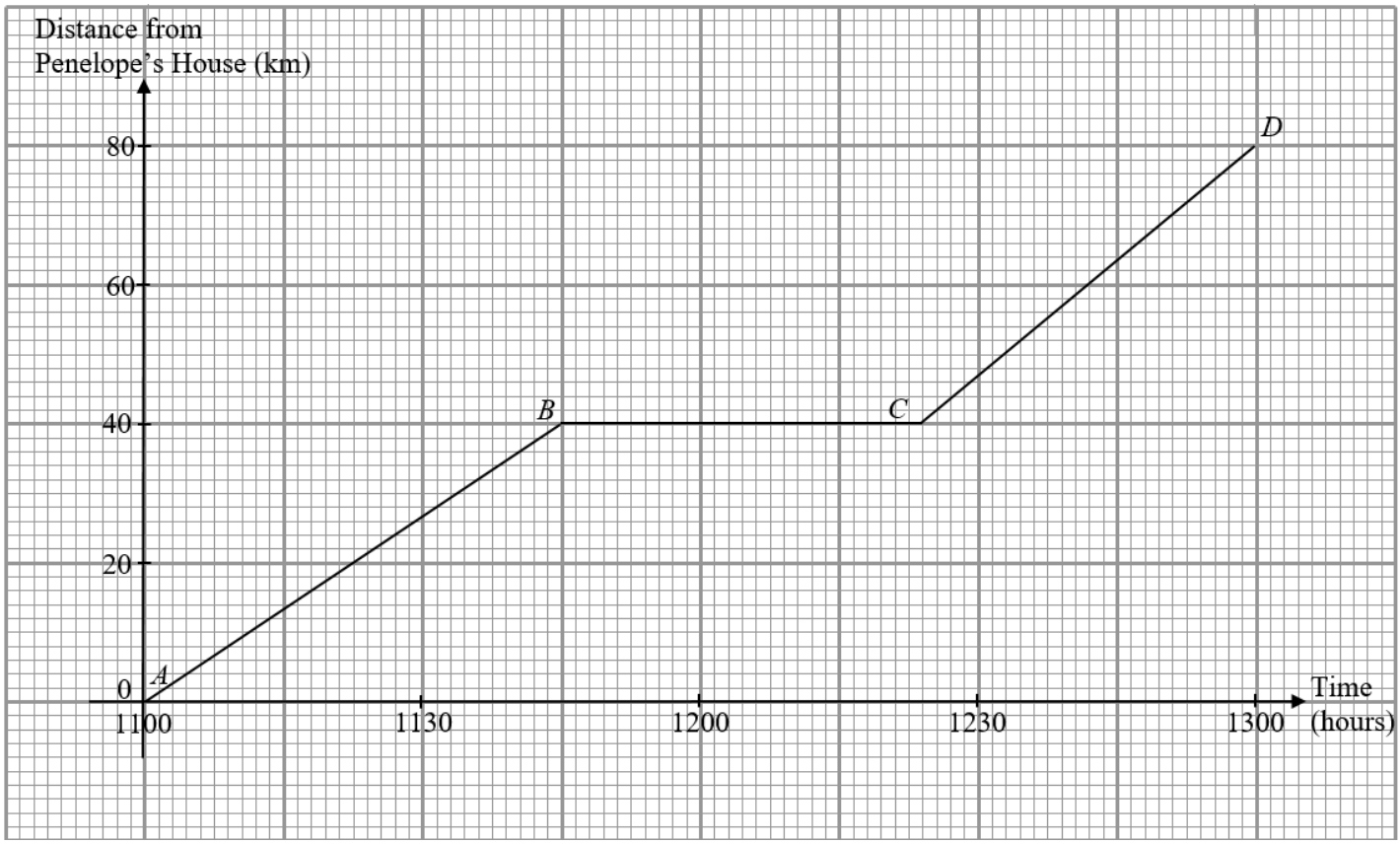
The equation of another straight line, L_2, is $y = 0.5x + 1$.

(ii) Determine if the point $(3, 2.5)$ lies on the straight line L_2. [2]

(iii) On the same grid above, draw the straight line L_2 for $-4 \le x \le 4$. [1]

(iv) Estimate the area of the triangle bounded by L_1, L_2 and the x-axis. [1]

9 The graph below shows Penelope's journey from her house to Hudson's house. During the journey, she stopped at a café for lunch, after which she continued her journey to Hudson's house.



Find the gradient of each of the following line segments, stating clearly what each gradient represents.

(i) AB [2]

(ii) BC [2]

(iii) Hudson claimed that Penelope travelled at a faster speed from Penelope's house to the café than from the café to his house. Is his claim accurate? Justify your answer, showing all working clearly. [2]

[Turn over

10 **(a)** John intends to train for a 21-km half marathon and decides to adopt a training programme. The distance he runs each day is reflected in the table below.

Day	Distance ran by John (in km)
1	1
2	1.4
3	1.8
4	2.2
5	
⋮	⋮
n	

Complete the table above. [2]

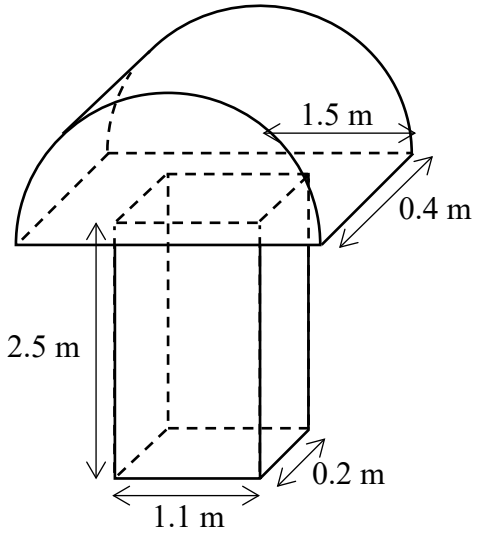
(b) Tom also intends to train for the 21-km half marathon but decides to adopt a different training programme. The distance he runs each day is reflected in the table below.

Day	Distance ran by Tom (in km)
1	0.5
2	1
3	2
4	4
5	8
⋮	
n	

(i) Find, showing your working clearly, the distance Tom ran on the n^{th} day leaving your answer in terms of n. [2]

(ii) Find the value of n such that the distance ran by Tom on Day n is at least the distance required to complete the half marathon. [2]

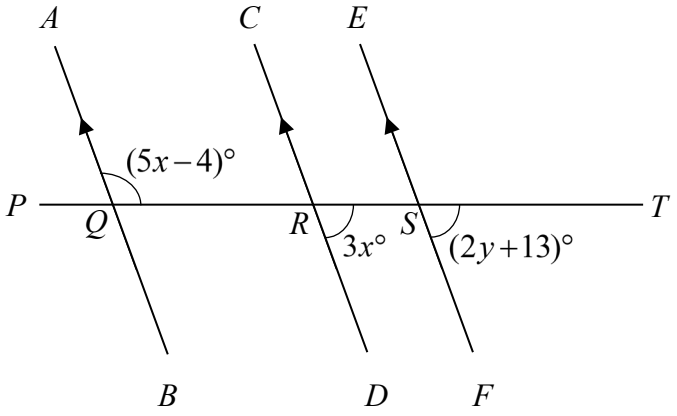
11 The diagram below (not drawn to scale) shows a metal statue that comprises of a closed half-cylinder that is mounted on a cuboid. The dimensions of the cuboid are 1.1 m by 0.2 m by 2.5 m. The radius of the semi-circular cross-section of the half-cylinder is 1.5 m and the breadth is 0.4 m.



(a) Find the volume of metal, in m^3, used to make the statue. [3]

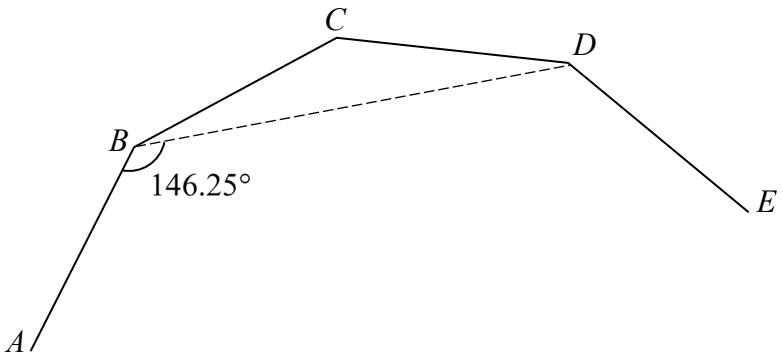
(b) Find the total surface area, in m^2, of the statue. [4]

12 In the figure below (not drawn to scale), AB is parallel to CD and EF. $PQRST$ is a straight line. Find the values of x and of y. [5]



[Turn over

13 In the diagram below (not drawn to scale), $ABCDE$ is part of a regular n-sided polygon where $\angle ABD = 146.25°$.



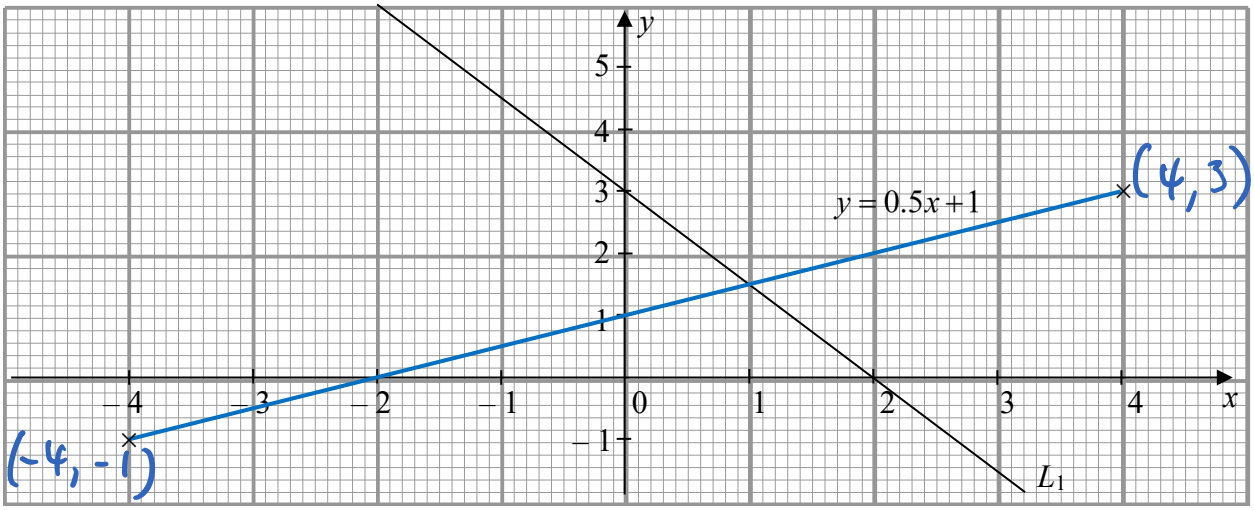
(i) Explain why triangle BCD is an isosceles triangle. [1]

(ii) Find the value of n. [5]

End of Paper

Answer Key

1	**(a)**	-2	**(b)**	\$380		
2	**(i)**	30	**(ii)**	10		
3	**(a)(i)**	$p^2q^3r^4$	**(ii)**	14	**(b)**	204 cm
4	**(a)**	$-x+\frac{5}{3}y+4$ or $\frac{-3x+5y+12}{3}$			**(b)**	$(2p-q)(1-6p-8q)$
5	**(a)**	$\frac{1}{3}$	**(b)**	$\frac{4}{3}$		
6	**(i)**	\$86	**(ii)**	3		
7	**(a)**	S\$10 752.69	**(b)**	7		
8	**(i)**	$y=-\frac{3}{2}x+3$	**(ii)**	Yes		
	(iii)		**(iv)**	3 units^2		



9 **(i)** $53\frac{1}{3}$; The gradient represents the speed in km/h at which Penelope travels from her house to the café.

(ii) 0; The gradient represents the speed. In this case, Penelope is taking her lunch and so her speed is zero.

(iii) $66\frac{2}{3}$; Penelope travelled faster from the café to Hudson's house than her house to the café.

10 **(a)**

Day	Distance ran by John (in km)
1	1
2	1.4
3	1.8
4	2.2
5	$1+(4)(0.4)=2.6$
⋮	⋮
n	$1+(n-1)(0.4)=0.4n+0.6$

(b)(i) 2^{n-2} km **(ii)** 7

11 **(a)** $1.96\ \text{m}^3$ **(b)** $16.7\ \text{m}^2$

12 $x=23,\ y=28$

13 **(ii)** 16