

NORTHBROOKS SECONDARY SCHOOL
End-of-Year Examination 2021
Secondary 2 Express



CANDIDATE NAME			
CLASS		REGISTER NUMBER	

MATHEMATICS

4052/01

Paper 1

7 October 2021

1 hour

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your register number, name and class on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

The number of marks is given in brackets [] at the end of each question or part question.

The total of the marks for this paper is 40.

FOR EXAMINER'S USE							
Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
							40

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This document consists of 11 printed pages.

Setter: Wang Pei Fen

Mathematical Formulae

Compound interest

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** the questions.

- 1 Given that $v = u + \frac{Ft}{m}$, express t in terms of F , m , u and v .

Answer [3]

- 2 Factorise fully $4ax + 3b + 12bx + a$.

Answer [3]

- 3 y is directly proportional to x^2 .
It is known that $y = 10$ when $x = 5$.

Find

- (a) the value of y when $x = 10$,

Answer $y = \dots\dots\dots$ [3]

- (b) the values of x when $y = \frac{1}{40}$.

Answer $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

5

- 4 Solve these simultaneous equations.

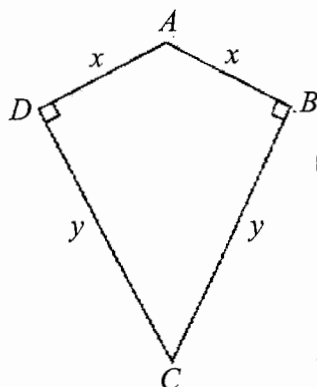
$$7c + 4d = 2$$

$$8c + 5d = 1$$

Answer $c = \dots\dots\dots$

$d = \dots\dots\dots[4]$

5



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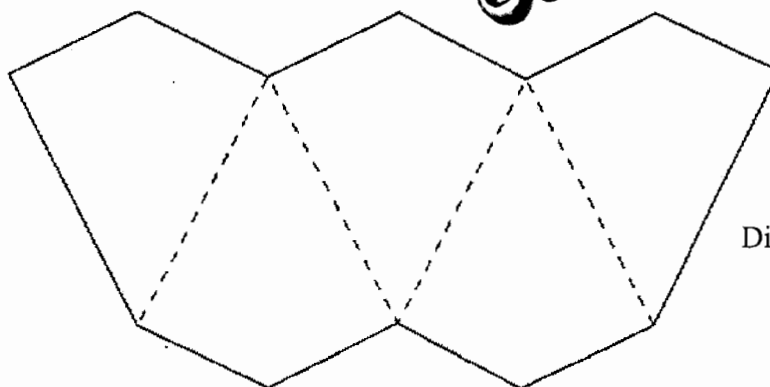


Diagram II

Diagram I shows a quadrilateral $ABCD$, in which $DA = AB = x$ cm and $BC = CD = y$ cm. Angle $ABC = \text{angle } CDA = 90^\circ$.

- (a) Show that the area of this quadrilateral is xy cm².

Answer

[2]

- (b) Area of this quadrilateral is 60 cm².

Express y in terms of x .

Answer [1]

Five of these quadrilaterals are joined together to make the shape shown in Diagram II.

- (c) Show that the outside perimeter, P cm of this shape is given by $P = 10x + \frac{120}{x}$.

Answer [2]

- (d) Given that $P = 74$, show that $5x^2 - 37x + 60 = 0$.

Answer [2]

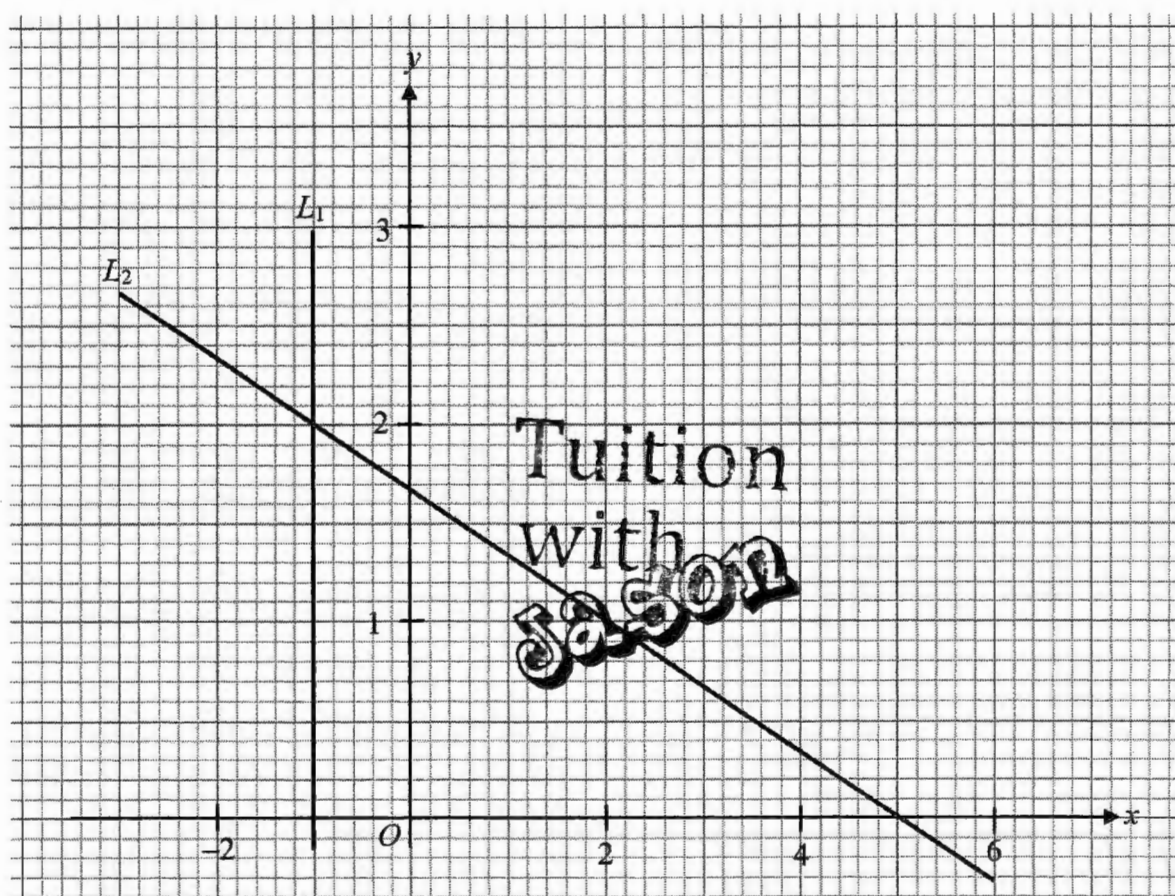
- (e) Solve the equation $5x^2 - 37x + 60 = 0$

Answer $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- (f) Find the two possible values of y when $P = 74$.

Answer $y = \dots\dots\dots$ or $y = \dots\dots\dots$ [2]

- 6 The diagram shows two lines, L_1 and L_2 .



- (a) Write down the equation of L_1 .

Answer [1]

- (b) Write down the coordinates of the point where L_2 crosses the x-axis.

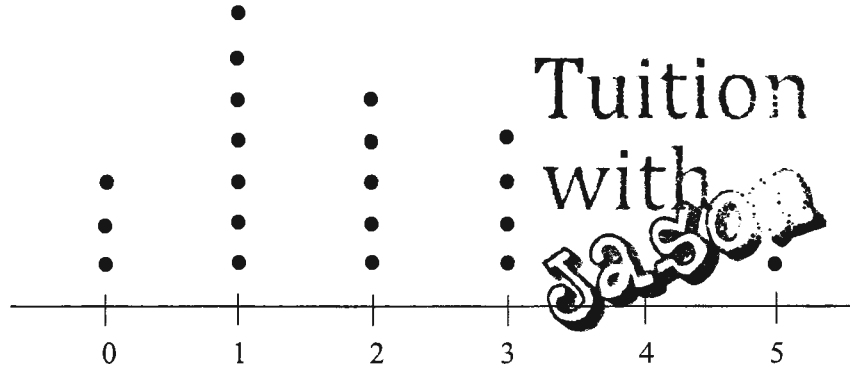
Answer (.....,) [1]

(c) (i) On the same axes, draw the graph of $y = x$. [1]

(ii) Hence write down the value of k such that the point (k, k) lies on L_2 .

Answer $k = \dots\dots\dots$ [1]

7



The dot diagram shows the number of children living in 20 HDB flats.

- (a) Find the total number of children in these 20 HDB flats

Answer children [2]

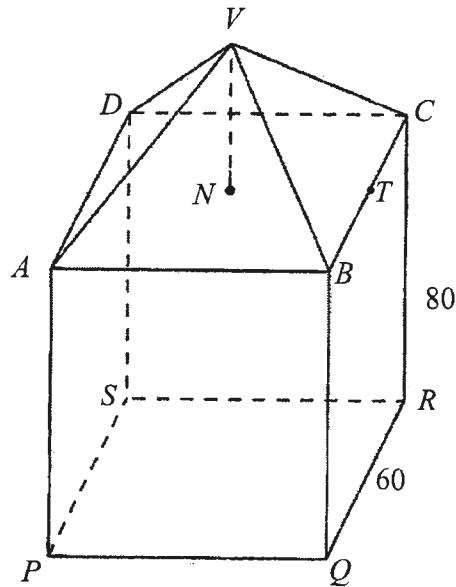
- (b) Find the number of flats that have less than 3 children living in them.

Answer [1]

- (c) A flat is selected at random.
Find the probability that the flat has at least 3 children living in it.

Answer [2]

8



The diagram shows a traffic bollard. It consists of a square-based pyramid, $VABCD$, attached to a cuboid, $ABCDPQRS$.

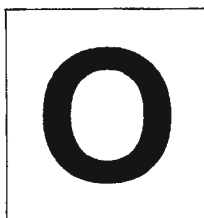
$ABCD$ and $PQRS$ are squares of side 60 cm.

The vertical height, VN , of the pyramid is 40 cm, and $VA = VB = VC = VD$.

$AP = BQ = CR = DS = 80$ cm.

Calculate the volume of the bollard.

Answer cm^3 [3]



NORTHBROOKS SECONDARY SCHOOL
End-of-Year Examination 2021
Secondary 2 Express



CANDIDATE NAME			
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MATHEMATICS**4052/02**

Paper 2

6 October 2021**1 hour 30 minutes**

Candidates answer on the Question Paper.

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The number of marks is given in brackets [] at the end of each question or part question.

The total of the marks for this paper is 60.

FOR EXAMINER'S USE							60
Q1	Q2	Q3	Q4	Q5	Q6	Q7	
Q8	Q9	Q10	Q11	Q12	Q13		

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Setter: Audrey Chong

Mathematical Formulae*Compound interest*

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3

Answer **all** the questions.

- 1 Expand and simplify $(5y - x)^2 - 2yx$.

Answer [2]

- 2 (a) Factorise $p^2 + 5p + 6$.

Answer [1]

- (b) Suggest a possible value of p for $p^2 + 5p + 6$ to be an even number.

Answer $p =$ [1]

4

- 3 Solve the equation $\frac{3x-1}{2} = 1$.

Answer $x = \dots\dots\dots$ [3]

- 4 Express $\frac{5y}{9y^2-4} + \frac{6}{3y-2}$ as a single fraction in the simplest form.

Answer $\dots\dots\dots$ [3]

5

- 5 9 men can complete a job in 20 days. Calculate how many men are required to complete the same job in 18 days, assuming that all men work at the same rate.

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Answer [2]

- 6 The cost of printing invitation cards consists of a fixed charge of \$45 and an additional charge of \$2.30 per card.

- (a) Write down an expression, in terms of x , for the total cost of printing x invitation cards.

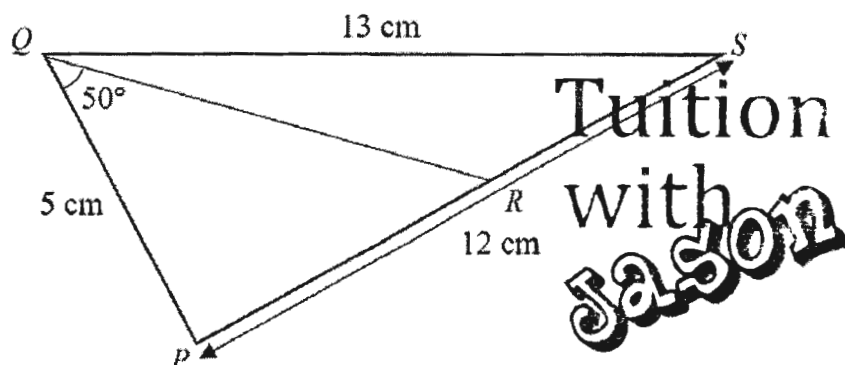
Answer \$. [2]

- (b) Melissa has \$360 and wants to print some invitation cards. Using your answer in (a), form an inequality to find the maximum number of invitation cards she can print.

Answer [3]

7

- 8 In the diagram, $PQ = 5$ cm, $PS = 12$ cm, $QS = 13$ cm and angle $PQR = 50^\circ$.



- (a) Show that triangle PQS is a right-angled triangle.

Answer

[3]

- (b) Calculate angle SQR .

Answer[2]

8

9 A floor plan has a scale of 2 cm to 4 m.

(a) Find the scale of the floor plan in the form 1 : n .

Answer 1 : [2]

(b) The length and breadth of a bedroom on the floor plan is 4 cm by 3 cm respectively.

Find the actual area, in m^2 , of the bedroom.

Answer m^2 [3]

(c) Yishun has an estimated area of 43.2 km^2 . Raymond intends to use the same scale to draw a map of Yishun.

Is this a good scale to use? Give a reason for your answer.

Answer

.....[1]

10 Simplify

(a) $\frac{121mn^2}{22m^3n},$

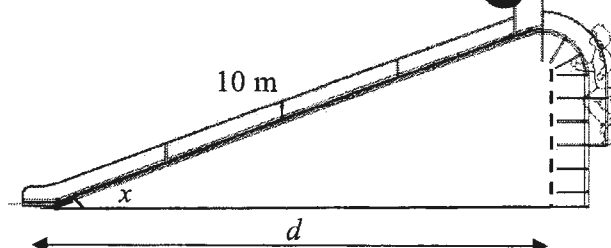
Answer [1]

(b) $\frac{(y-2)}{15x} \div \frac{3y-6}{(3x)^2}.$

Answer [4]

10

- 11 The diagram below shows a slide.
The ladder attached to the slide is vertical to the ground.
The angle formed by the slide and the ground is angle x .
The length of the slide is 10 m.



- (a) Given that $\sin x = \frac{3}{5}$, find angle x .

Answer[1]

- (b) Calculate the height of the ladder.

Answerm [2]

- (c) Calculate the horizontal distance, d , from the base of the slide to the base of the ladder.

Answerm [2]

11

- 12** At an amusement park, one of the attractions is a rollercoaster ride. For a portion of the ride, the height, h metres, of the rollercoaster above the ground after t seconds is given by the formula $h = 25t - 3t^2$. Some corresponding values of t and h are given in the table below.

t	0	1	2	3	4	5	6	7
h	0	22	38	48	52	a	42	28

- (a) Find the value of a .

Answer $a = \dots\dots\dots$ [1]

- (b) On the grid on page 12, draw the graph of $h = 25t - 3t^2$ for $0 \leq t \leq 7$. [2]

- (c) Use your graph to find

- (i) the shortest time taken for the rollercoaster to reach a height of 30 metres,

Answer $\dots\dots\dots$ s [1]

- (ii) the maximum height reached by the rollercoaster above the ground.

Answer $\dots\dots\dots$ m [1]

- (d) For patrons who do not want to ride this rollercoaster, they can take the “Long Elevator” ride that is built beside the rollercoaster. This elevator ride can be modelled by the equation $h = 5t + 10$.

- (i) On the same grid, draw the line $h = 5t + 10$ for $0 \leq t \leq 7$. [3]

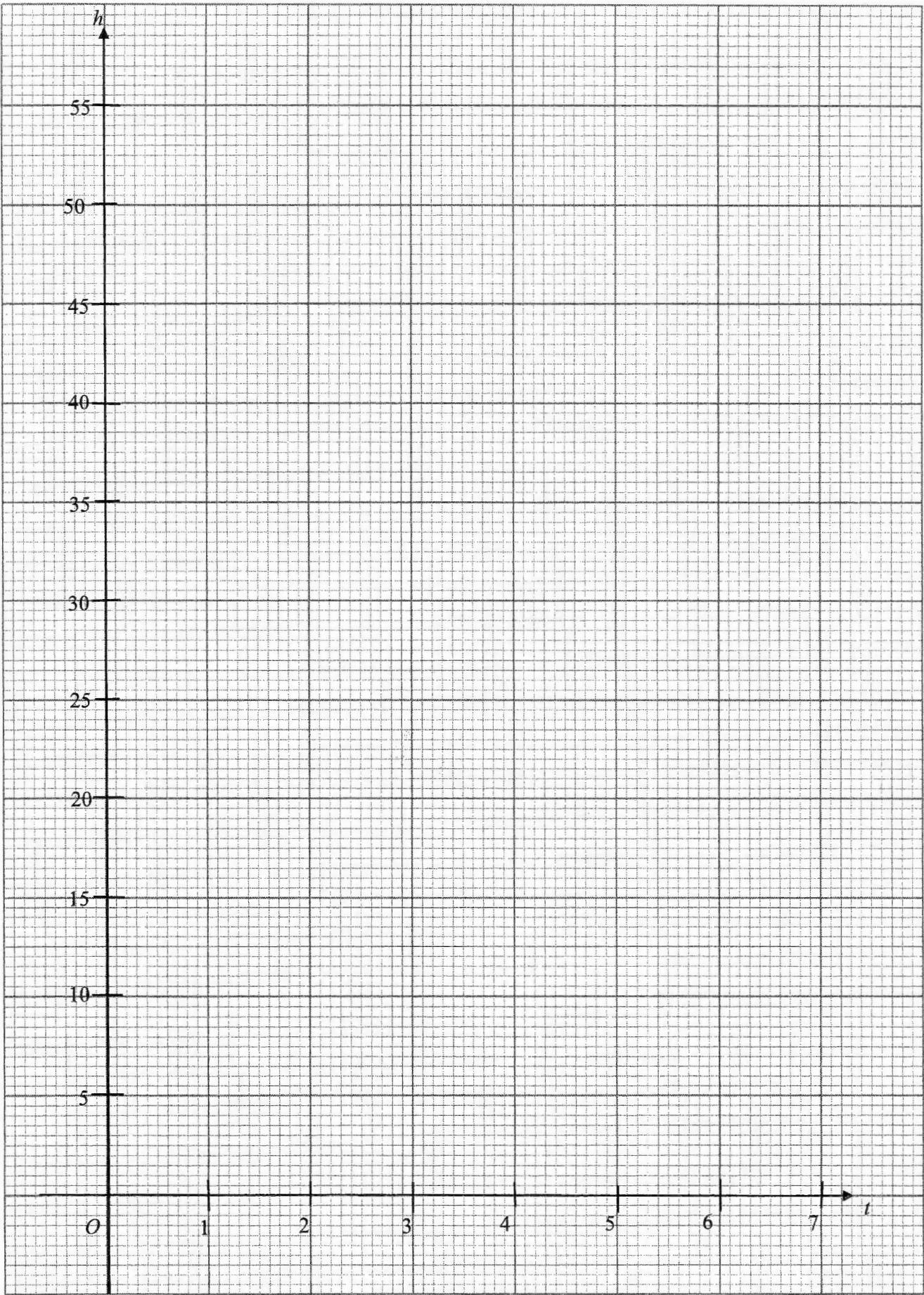
- (ii) Write down the x -coordinates of the points where this line intersects the curve.

Answer $t = \dots\dots\dots$ and $\dots\dots\dots$ [1]

- (iii) Explain the significance of the values found in (d)(ii).

.....

.....[1]



13 Uma makes her own ice-cream at home. She scoops her ice-cream in the shape of a sphere with a radius of 4 cm.

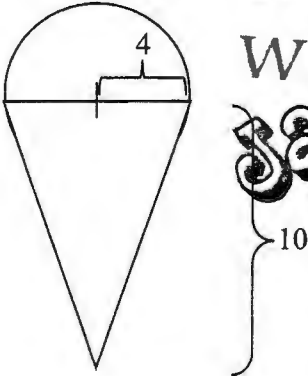
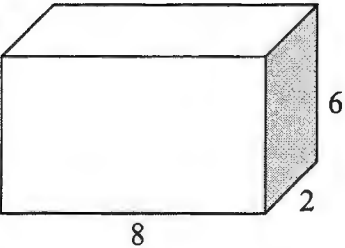
(a) Find the volume of one scoop of ice-cream. Leave your answer in cm^3 .

Answer cm^3 [2]

(b) Uma decides to sell her homemade ice-cream at a funfair. She is deciding on one of the following items to sell at the funfair.

The selling price for the ice-cream cone and ice-cream bread is \$2.50 and \$2 respectively.

The following information is provided.

Ice-cream cone	Ice-cream bread
Cost price of cone: \$0.50/cone The ice-cream cone is shown below, with the cone fully filled with ice-cream and a scoop of ice-cream in the shape of a hemisphere on top.  The radius of the scoop of ice-cream is 4 cm and the height of the cone is 10 cm.	Cost price of bread: \$0.35/slice of bread The ice-cream bread is shown below, with one block of ice-cream and a slice of bread.  The block of ice-cream can be modelled as a cuboid as shown below, with dimensions 8 cm by 2 cm by 6 cm. 
The cost price of 10 cm^3 of ice-cream is 2 cents.	

14

Assuming that the demand for both items are the same, which item will you advise Uma to sell?

Justify your decision with mathematical calculations and reasoning.

Answer

[5]

NORTHBROOKS SECONDARY SCHOOL
MATHEMATICS DEPARTMENT
SECONDARY TWO EXPRESS
MATHEMATICS

END OF YEAR PAPER 1 MARKING SCHEME 2021

No.	Suggested Steps	Marks	Remarks
1	$v - u = \frac{Ft}{m}$ $m(v - u) = Ft$ $t = \frac{m(v - u)}{F}$	M1 M1 A1	$vm = um + Ft$ $Ft = vm - um$
2	$a(4x + 1) + 3b(1 + 4x)$ $(a + 3b)(4x + 1)$	M1 A1, A1	
3(a)	$y = kx^2$ or $\frac{y}{x^2} = k$ $y = \frac{2}{5}x^2$ or $\frac{y}{x^2} = \frac{2}{5}$ $y = 40$	M1 M1 A1	
3(b)	$x^2 = \frac{1}{16}$ $x = \frac{1}{4}$ or $x = -\frac{1}{4}$	M1 A1, A1	$(1 - 4x)(1 + 4x) = 0$
4	Making the coefficient of one of the variables the same or making either c or d the subject Form equation with one variable $c = 2$ $d = -3$	M1 M1 A1 A1	
5(a)	Area of triangle ADC = area of triangle ABC Area of quadrilateral = $2 \times \frac{1}{2} \times xy$ = xy (shown)	M1 A1	Accept any other reasonable working
5(b)	$y = \frac{60}{x}$	B1	

No.	Suggested Steps	Marks	Remarks
5(c)	$P = 10x + 2y$ Sub $y = \frac{60}{x}$ to get $P = 10x + \frac{120}{x}$	M1 A1	
5(d)	$74 = 10x + \frac{120}{x}$ $10x^2 - 74x + 120 = 0$ $5x^2 - 37x + 60 = 0$ (shown)	M1 A1	Either multiply by x or divide by 2
5(e)	$(5x - 12)(x - 5) = 0$ $x = 2\frac{2}{5}$ or $x = 5$	M1 A1, A1	
5(f)	$y = 25$ or $y = 12$	B1, B1	
6(a)	$x = -1$	B1	
6(b)	$(5, 0)$	B1	
6(c)i	Draw $y = x$ correctly	B1	
6(c)ii	Accept answer between 1.2 and 1.3 inclusive	B1	
7(a)	$0 + 7 + 10 + 12 + 5$ $= 34$	M1 A1	
7(b)	15	B1	
7(c)	$\frac{5}{20}$ $= \frac{1}{4}$	M1 A1	
8	$60 \times 60 \times 80$ $\frac{1}{3} \times 60 \times 60 \times 40$ 336000	M1 M1 A1	

NORTHBROOKS SECONDARY SCHOOL
MATHEMATICS DEPARTMENT
2 EXPRESS
MATHEMATICS

END OF YEAR PAPER 2 MARKING SCHEME 2021

1	$(5y-x)^2 - 2yx$ $= 25y^2 - 10xy + x^2 - 2yx$ $= 25y^2 - 12xy + x^2$	B(2,1,0)								
2a	$(p+2)(p+3)$	B1								
2b	accept any suitable value of p that makes $p^2 + 5p + 6$ an even number.	B1								
3	$\frac{3x-1}{2} = 1$ $3x-1 = 2$ $3x = 3$ $x = 1$	M1 M1 A1								
4	$\frac{5y}{9y^2-4} + \frac{6}{3y-2}$ $= \frac{5y}{(3y+2)(3y-2)} + \frac{6}{3y-2}$ $= \frac{5y}{(3y+2)(3y-2)} + \frac{6}{3y-2}$ $= \frac{5y+6(3y+2)}{(3y+2)(3y-2)}$ $= \frac{5y+18y+12}{(3y+2)(3y-2)}$ $= \frac{23y+12}{(3y+2)(3y-2)}$	M1 – factorisation M1 – combining fraction A1								
5	<table><tr><th>No. of days</th><th>No. of men required</th></tr><tr><td>20</td><td>9</td></tr><tr><td>1</td><td>180</td></tr><tr><td>18</td><td>10</td></tr></table>	No. of days	No. of men required	20	9	1	180	18	10	M1 A1
No. of days	No. of men required									
20	9									
1	180									
18	10									
6a	$45 + 2.3x$	B1, B1								
6b	$45 + 2.3x < 360$ $2.3x < 315$ $x < \frac{315}{2.3}$ $x < 136.96$ Greatest no. of invitation card is 136.	M1 M1 A1								

7a	<table><tr><th>Stem</th><th>Leaf</th></tr><tr><td>0</td><td>5 7 9</td></tr><tr><td>1</td><td>0 4</td></tr><tr><td>2</td><td>1 2 5 6 6 7 9</td></tr><tr><td>3</td><td>3 4 8</td></tr><tr><td>4</td><td>0</td></tr></table>	Stem	Leaf	0	5 7 9	1	0 4	2	1 2 5 6 6 7 9	3	3 4 8	4	0	B3 (deduct 1 mark per mistake made)
Stem	Leaf													
0	5 7 9													
1	0 4													
2	1 2 5 6 6 7 9													
3	3 4 8													
4	0													
7b	$\frac{3}{16}$	B2												
8a	$QS^2 = 13^2 = 169$ $QP^2 + PS^2 = 5^2 + 12^2$ $= 169$ Since $QS^2 = QP^2 + PS^2$, by the converse of Pythagoras' Theorem, triangle PQS is a right-angled triangle.	M1 M1 A1 – need to mention converse of Pythagoras Theorem												
8b	Using any trigo ratio to find angle SQP , $\angle SQP = 67.380^\circ$ $\angle SQR = 67.380^\circ - 50^\circ$ $\approx 17.4^\circ$ (1dp)	M1 – angle SQP A1												
9a	2 cm : 4 m 2 cm : 400 cm 1 : 200 or 2 cm : 4 m 1 cm : 2 m 1 : 200	M1 A1 M1 A1												
9b	Area of bedroom on plan = $4 \times 3 = 12 \text{ cm}^2$ Scale = 2 cm : 4 m = 1 cm : 2 m Area = $1 \text{ cm}^2 : 4 \text{ m}^2$ = $12 \text{ cm}^2 : 48 \text{ m}^2$	M1 M1 A1												
9c	Not a good scale to use because the map of Yishun would be too big.	B1												
10a	$\frac{11n}{2m^2}$	B1												

10b	$\frac{y-2}{15x} \div \frac{3y-6}{(3x)^2}$ $= \frac{y-2}{15x} \times \frac{(3x)^2}{3y-6}$ $= \frac{y-2}{15x} \times \frac{9x^2}{3(y-2)}$ $= \frac{x}{5}$	M1 – KCF M1 – factorization M1 – expansion A1
11a	$\angle x = \sin^{-1}\left(\frac{3}{5}\right)$ $= 36.9^\circ$	B1
11b	$\frac{\text{height of ladder}}{10} = \frac{3}{5}$ $\text{height of ladder} = \frac{3}{5} \times 10$ $= 6$	M1 A1
11c	$d = \sqrt{10^2 - 6^2}$ $= 8$	M1 A1
12a	50	B1
b	(see attached graph) All points plotted correctly Smooth curve	B1 B1
ci	1.4 seconds	B1
cii	52 m	B1
di	Table of values Correct line drawn Label line with equation	B1 B1 B1
dii	$t = 0.5$ or 6.15 sec (SLSS to draw and get the range)	B1
diii	It represents the timings at which the Elevator ride is at the same height as the roller coaster.	B1
13a	$\frac{4}{3} \times \pi \times 4^3$ $= 268.08$ $= 268 \text{ cm}^3$	M1 – correct formula and radius either in cm/mm A1 – final ans in cm^3
13b	Volume of ice cream cone $= \frac{1}{2} \times 268.08 + \frac{1}{3} \pi (4)^2 (10)$ $= 301.59 \text{ cm}^3$ Cost price of ice cream cone	M1 – vol of cone and hemisphere

$= \left(\frac{301.59}{10} \times 0.02 \right) + 0.50$ $= \$1.1031$ Profit from each ice-cream cone $= 2.50 - 1.10318$ $= \$1.3969$ Volume of ice cream block $= 8 \times 6 \times 2$ $= 96 \text{ cm}^3$ Cost price of each ice-cream bread $= \left(\frac{96}{10} \times 0.02 \right) + 0.35$ $= \$0.542$ Profit (ice-cream bread) $= 2 - 0.542$ $= \$1.458$ Emma should sell <u>ice-cream bread</u> so as to <u>maximize profits</u>.	M1 – calculation of profit earned M1 – vol of cuboid M1 – calculation of profit earned A1 – item chosen to sell and reasoning
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