EXP

PUNGGOL SECONDARY SCHOOL
SECONDARY 1
EXPRESS
END-OF-YEAR EXAMINATION

QUESTION & ANSWER BOOKLET

NAME

CLASS

INDEX NUMBER

Mathematics **4048**

Paper 1

5 October 2021

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your class, register number and name on all the work you hand in.
Write in dark blue or black ink on both sides of the paper.
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.

At the end of the examination, fasten all your work securely together.
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 50.

For Examiner's use	
Total	/50

Parent's Signature

This paper consists of **12** printed pages and **0** blank page.

Setter(s) : Mr Chia Jia Juen	Vetter : Mr Gerald Foo Mdm Jillian Khong

2

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

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

Arc length = $r\theta$, where θ 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

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

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

1 By rounding each number to the nearest integer, estimate the value of $\frac{5.78^2}{13.11+\sqrt{24.99}}$.

Give your answer correct to 1 significant figure.

Answer ..... [2]

---

2 Consider the numbers below.

-4, $\sqrt{19}$, $\sqrt[3]{125}$, 4π, 16

(a) Write down all perfect square(s),

Answer [1]

.....

(b) Write down all irrational number(s).

Answer [1]

.....

---

3 Consider the following numbers.

88%, $-\frac{88}{100}$, $0.\dot{8}$, $-\sqrt{64}$

Arrange the numbers in ascending order.

Answer ....., ..., ..., ... [2]

---

4 Factorise the following expressions completely.

(a) $6ab-15b+36$

Answer ..... [1]

(b) $4(x-5y)+3z(-5y+x)$

Answer ..... [1]

---

5 Every month, Ben spends 50% of his salary on food, $\frac{1}{4}$ on entertainment, $\frac{2}{5}$ of the remainder on investments and saves the rest.

(a) Find the fraction of the money that Ben saves.

Answer ..... [2]

(b) If Ben saves \$600, find his monthly salary.

Answer \$ ..... [1]

---

6 **(a)** Simplify $2a-[3-5(a+2)]$.

Answer ..... [2]

(b) It is given that $P=q^2+\frac{4}{5}r$.

Find P when $q=-3$ and $r=15$.

Answer $P=$ ..... [1]

---

7 **(a)** Express 28 minutes as a percentage of 2 hours and 45 minutes.

Answer ..... % [2]

(b) When a number x is increased by 3%, the result is 412. Find x.

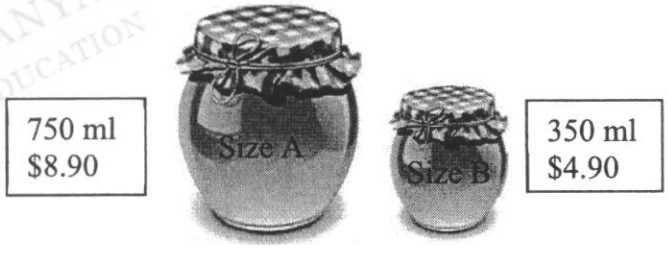
Answer $x=$ ..... [2]

---

8 **(a)** Given that $x : y = 1 : 2$ and $y : z = 3 : 5$, find $x : y : z$.

Answer $x : y : z =$ ..... : ..... : ..... [2]

(b) A brand of honey is sold in two different sizes at a local supermarket. The volume of the honey and their price is shown below.



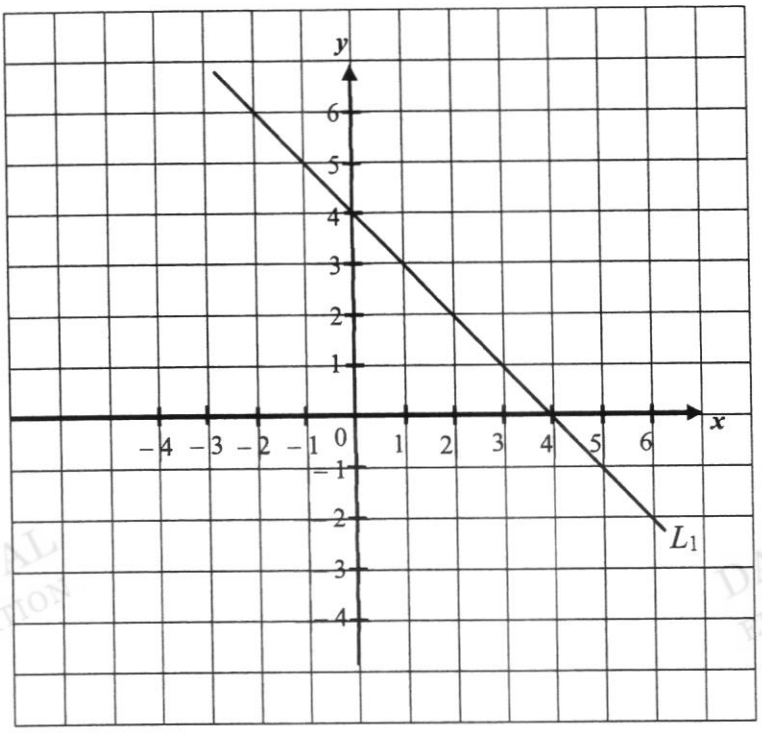
Which size would give you better value for money? Justify your answer.

Answer

Size ..... gives a better value for money because .....

..... [2]

9 The line L_1 is drawn in the grid below.



(a) Write down the y-intercept and gradient of the line L_1.

Answer y-intercept = ... [1]

gradient = ... [1]

(b) Another line L_2 has the same y-intercept as line L_1.
On the grid above, draw and label the line L_2 if the gradient of line L_2 is 2. [2]

10 When written as a product of its prime factors, $132 = 2^2 \times 3 \times 11$.

(a) Express 1350 as a product of its prime factors, giving your answer in index notation.

Answer 1350 = ... [2]

(b) Hence find

(i) the greatest integer that will divide both 132 and 1350 exactly,

Answer ..... [1]

(ii) the LCM of 132 and 1350,

Answer ..... [1]

(iii) the smallest integer k such that $1350k$ is a perfect cube.

Answer k = ... [1]

11 Kenny cycled from Town X to Town Y at an average speed of 15 km/h for 80 minutes. After reaching Town Y, he rested for 25 minutes before cycling another 5 km from Town Y to Town Z in 45 minutes.

(a) Find the time he would reach Town Z if he left Town X at 10 45.

Answer ..... [2]

(b) Find the distance he travelled from Town X to Town Y.

Answer ..... km [2]

(c) Find Kenny's average speed for his journey from Town X to Town Z.

Answer ..... km/h [2]

12 In a hexagon, three of the interior angles are 99°, 105° and 120°. The remaining interior angles are $(2x+29)^\circ$, $(3x-19)^\circ$ and $(4x+35)^\circ$.

Find

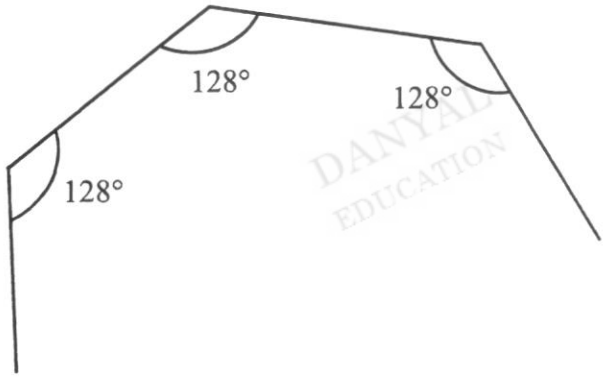
(a) **(i)** the value of x,

Answer $x =$ ..... [3]

(ii) the largest interior angle of the hexagon.

Answer ..... [1]

(b) Abbas claims that the diagram below shows part of a **regular** polygon.
Is he correct? Show your working clearly.

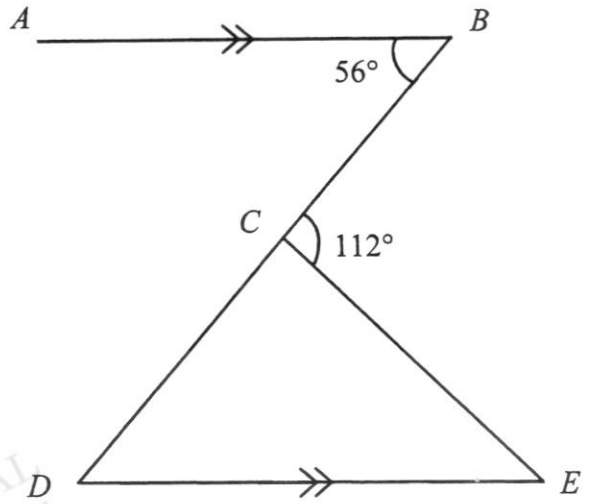


Answer

Abbas is ..... because .....

..... [2]

13 In the diagram below, BCD is a straight line and AB is parallel to DE.
It is given that $\angle ABC = 56^\circ$ and $\angle BCE = 112^\circ$.



Find, stating your reasons clearly,

(a) $\angle BDE$,

Answer

$\angle BDE$ is .....° because ..... [2]

(b) Reflex $\angle DCE$,

Answer

Reflex $\angle DCE$ is .....° because .....

..... [3]

The question continues on next page

(c) Daniel claims that ΔCDE is an isosceles triangle. Explain why he is correct, showing your working clearly.

Answer

ΔCDE is an isosceles triangle because .....

..... [2]

--------- End of Paper ---------

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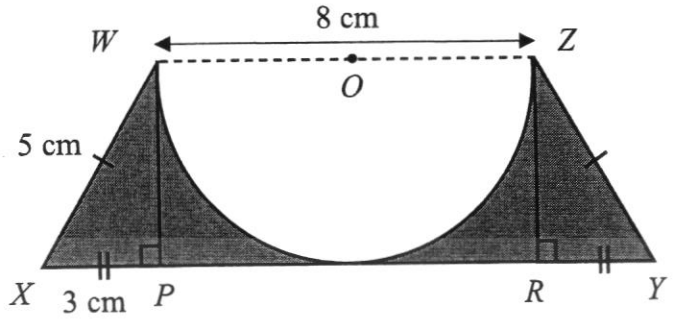
1 The figure shows a trapezium $WXYZ$. WZ is the diameter of a circle with centre O.

It is given that $WZ = 8$ cm, $WX = ZY = 5$ cm and $XP = RY = 3$ cm.



Find

(a) the area of the shaded region,

Answer ..... cm^2 [2]

(b) the perimeter of the shaded region.

Answer ..... cm [2]

2 **(a)** Construct a quadrilateral $WXYZ$ where $WX = 9$ cm, $XY = 6$ cm, $WZ = 8$ cm, $\angle XWZ = 60°$ and $\angle WXY = 90°$. The line WX has been drawn for you. [2]

(b) Measure $\angle XYZ$.

Answer $\angle XYZ =$ .....° [1]

(c) Measure the length of ZY.

Answer $ZY =$ ..... cm [1]

3 The terms T_1, T_2, T_3, T_4 of a sequence are given as follows:

$$T_1 = 2^2$$
$$T_2 = 3^2$$
$$T_3 = 4^2$$
$$T_4 = 5^2$$
$$\vdots$$

(a) Write down the 6^{th} term in the sequence.

Answer ..... [1]

(b) Write down in terms of n, the n^{th} term of the sequence above.

Answer T_n = ... [1]

(c) Given that $T_n = 225$, find the value of n.

Answer ..... [2]

4 The following table shows some points which the equation $y = 2x - 3$ passes through.

x	-3	0	4
y	-9	-3	p

(a) Find the value of p.

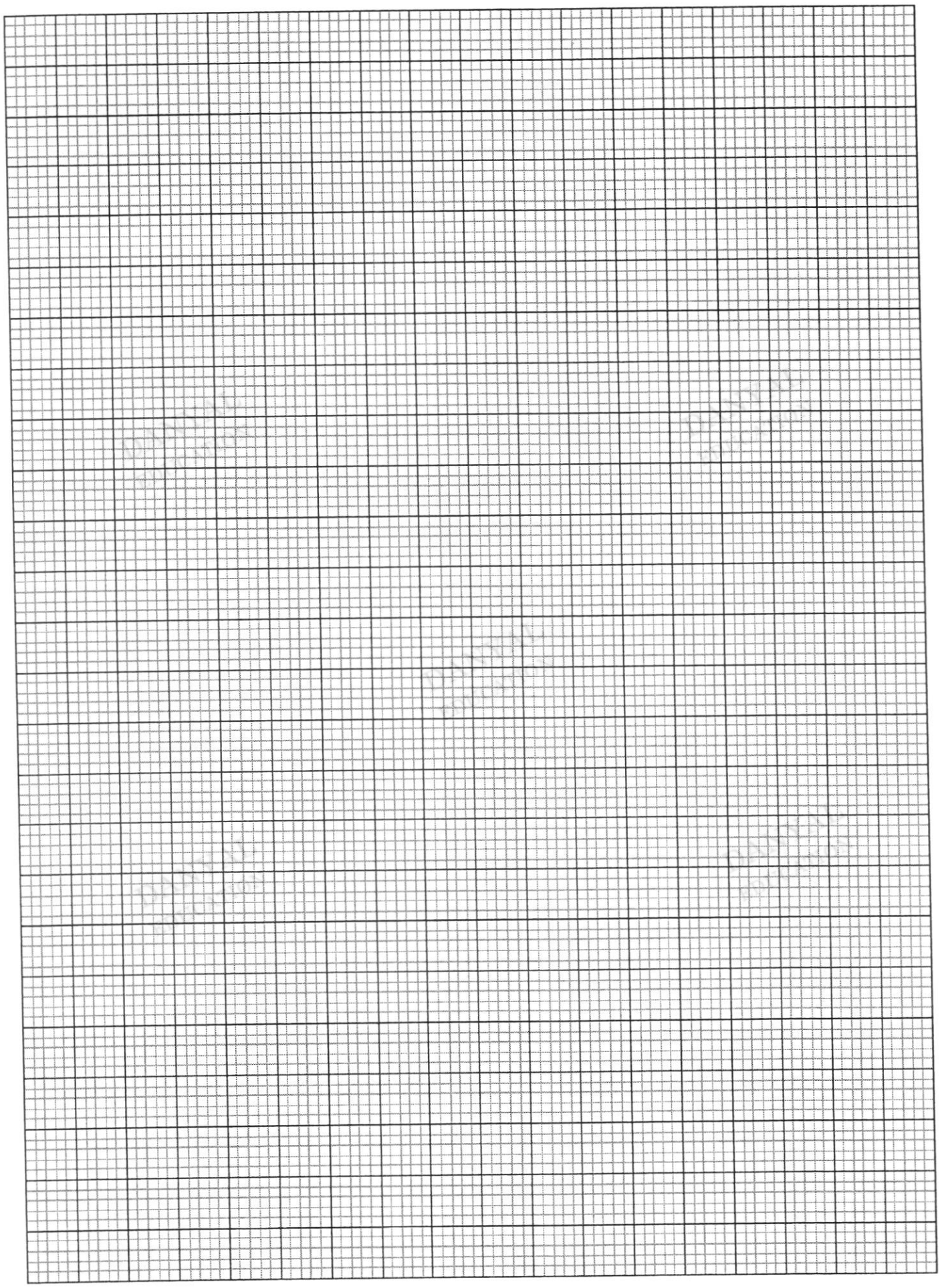
Answer $p =$ ..... [1]

(b) On the grid opposite, draw and label the graph of $y = 2x - 3$ for $-3 \leq x \leq 4$ using a scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 2 units on the y-axis. [2]

(c) On the same graph, draw the line $x = 2$. [1]

(d) Hence write down the coordinates of the point where $y = 2x - 3$ and $x = 2$ meet.

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



5 **(a)** Express $\frac{x+4}{2}-\frac{5(x-1)}{3}$ as a single fraction.

Answer ..... [3]

(b) Solve the equation $\frac{2y+5}{3}=\frac{2(7-y)}{5}$.

Answer $y =$ ..... [2]

6 Given that $(n+1)$ is a positive odd integer,

(a) Write the expressions for the next two consecutive odd numbers in terms of n.

Answer ....., ... [2]

(b) Find, in the simplest form, the expression for the sum of these three consecutive odd numbers.

Answer ..... [1]

(c) Given that the sum of the three consecutive odd numbers is 333, find the value of n.

Answer $n =$..... [2]

7 The manufacturing cost of making a watch is $1200. It is divided between materials, wages and utilities in the ratio 3 : 4 : 5.

(a) Calculate the cost of wages used in making each toy.

Answer $ ..... [1]

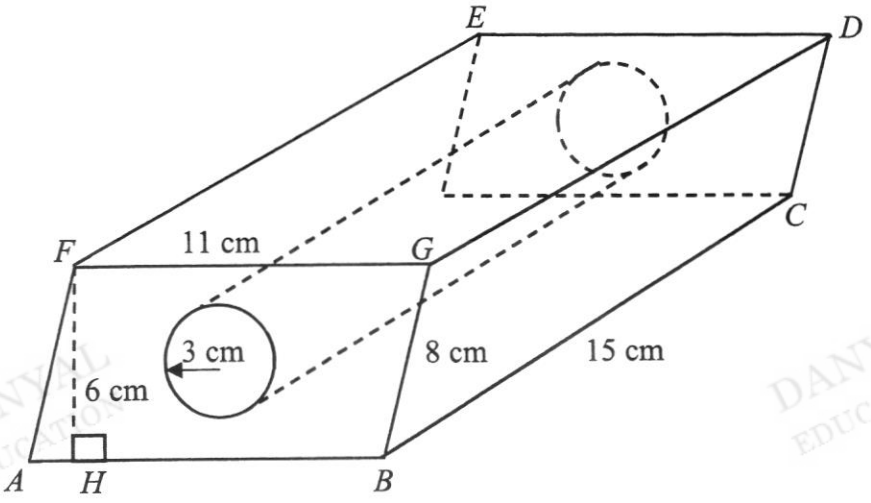
(b) A second manufacturer sells each watch for $1480, earning a profit of 25% on the manufacturing cost. Calculate the manufacturing cost of each watch.

Answer $ ..... [2]

(c) In 2020, a third manufacturer found that the cost of making a watch was divided between materials, wages and utilities in the ratio of 1 : 2 : 3. In 2021, the costs of materials and wages were doubled while the cost of utilities remained the same. Calculate the total percentage increase in the manufacturing cost from 2020 to 2021.

Answer ..... % [3]

8 The diagram below shows a steel block, *ABCDEFG* in the form of a prism with a cross-section that is a parallelogram. A cylinder with a cross-sectional radius of 3 cm is removed from the middle of the block. It is given that $BC = 15$ cm, $BG = 8$ cm, $FG = 11$ cm and $FH = 6$ cm.



(a) Calculate the volume of the steel block, *ABCDEFG*.

Answer ..... cm^3 [2]

(b) Calculate the total surface area of the steel block, *ABCDEFG*.

Answer ..... cm^2 [4]

The question continues on next page

(c) The steel block, *ABCDEFG* is subsequently melted and then shaped into a cube. Find the total surface area of the cube.

Answer ..... cm^2 [3]

9 Mrs Lim is meeting her friends at East Coast Park for a picnic at a certain time of the day. She has decided to hire a private vehicle to take her from her home at Punggol Watercress to the location. There are two choices of companies which she can choose from – Comeford Taxi and Greb.

The pricing information for each company is given below.

Comeford Taxi		
Flag down fare*		$3.20
Every 400m thereafter or less, up to the first 10 km		$0.22
Every 300m thereafter or less, for the remaining part of the journey		$0.15
Peak hour surcharge:	Monday to Friday, 6am – 9.29am Monday to Sunday, 6pm – 11.59pm	25% of the meter fare
	Monday to Sunday, 12am – 5.59am	50% of the meter fare
Greb		
Base Fare		$2.50
Per Km		$0.50
Per minute of travel time		$0.16
* *Flag down fare refers to the flat rate that a passenger has to pay the moment he or she hails a taxi. The flag down fare is independent of the distance travelled.*		
** *Peak hours for Greb are the same as Comeford Taxi.*		

(a) Using Googre Maps, Mrs Lim found that the distance between her home and East Coast Park is 19 km. It is given that the average speed for a car to travel from her home to East Coast Park during non-peak hours is 70 km/h.
Find the time taken for her to reach East Coast Park during non-peak hours, giving your answer correct to the nearest minute.

Answer ..... min [2]

The question continues on next page

(b) If Mrs Lim wants to make the same trip at 5pm on a Tuesday, calculate the amount of money that she will need to pay if she chooses Greb.

Answer $..... [1]

(c) Mrs Lim finally decides to make the trip at 8.30am on a Friday. Due to heavier traffic conditions on that Friday morning, Mrs Lim took 5 minutes longer than usual to travel from her home to East Coast Park.
Mrs Lim wants to save as much money on transport as possible. With the aid of relevant calculations, explain which taxi company she should choose.

Answer Mrs Lim should choose ..... because.....

.....

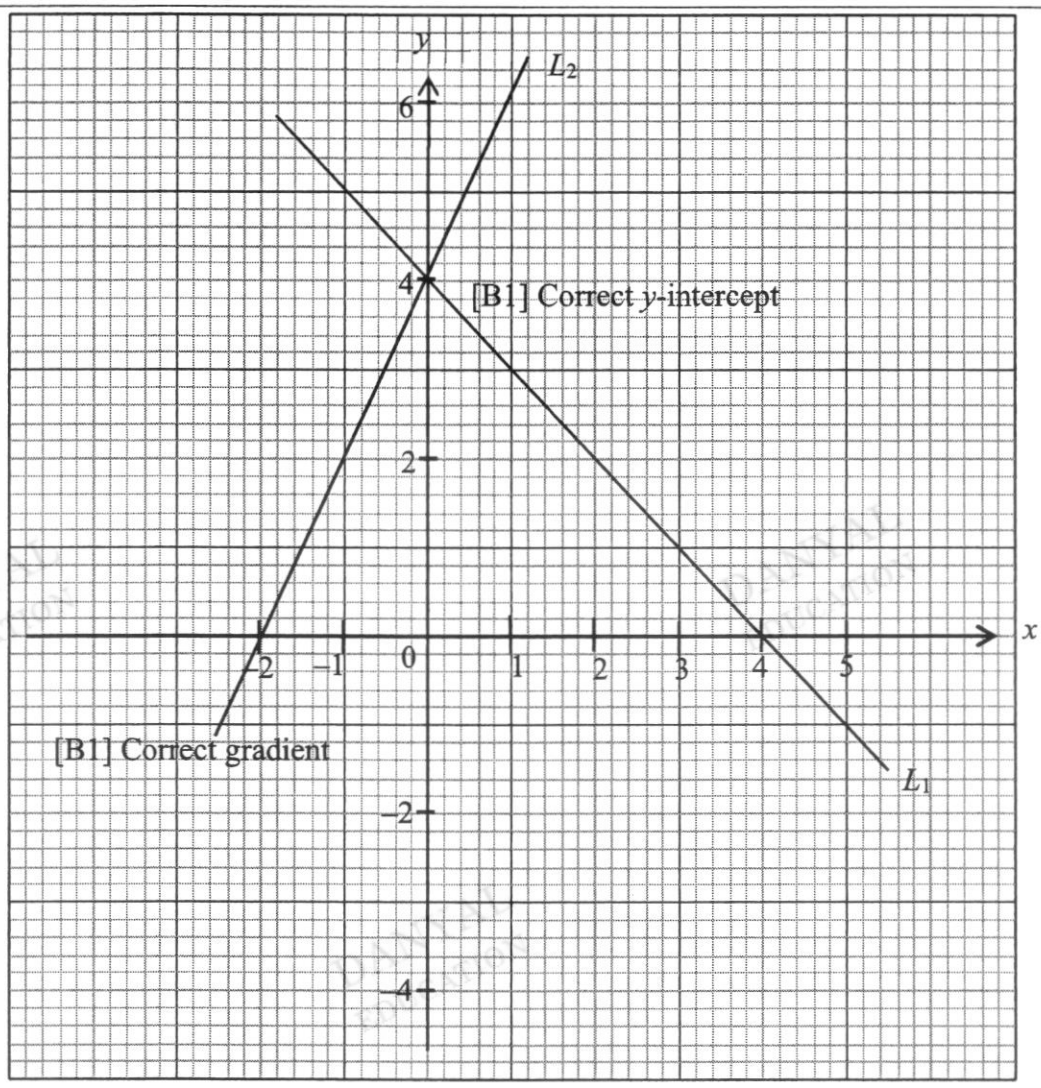
..... [5]

--------- End of Paper ---------

Punggol Secondary School 2021 Sec 1 Express EOY Exam Paper 1: Marking Scheme				
1		$\frac{5.78^2}{13.11+\sqrt{24.99}} \approx \frac{6^2}{13+\sqrt{25}}$ $=2$	M1 A1	Award M1 only if 5.78, 13.11 **and** 24.99 are rounded correctly.
2	**(a)**	16	B1	
	(b)	$\sqrt{19}$, 4π	B1	
3		$-\sqrt{64}, -\frac{88}{100}$, 88%, 0.8	B1, B1	Award B1 for first 2 answers correct and B1 for last 2 answers correct
4	**(a)**	$3(2ab-5b+12)$	B1	
	(b)	$(4+3z)(x-5y)$	B1	
5	**(a)**	$\left(1-\frac{1}{2}-\frac{1}{4}\right)\times\frac{3}{5}$ $=\frac{3}{20}$	M1 A1	
	(b)	$\frac{600}{3}\times 20$ $=\$4000$	B1	
6	**(a)**	$2a-[3-5(a+2)]$ $=2a-[3-5a-10]$ $=2a-[-7-5a]$ $=2a+7+5a$ $=7a+7$	M1 A1	Award M1 for correct expansion of inner brackets
	(b)	$P=(-3)^2+\frac{4}{5}(15)$ $=21$	B1	
7	**(a)**	$\frac{28}{(2\times 60)+45}\times 100\%$ $=16\frac{32}{33}\%$	M1 A1	Award M1 for converting 2 h 45 min to min. Accept 17.0% (3 s.f.)

	(b)	$x = \frac{412}{103} \times 100\%$ $= 400$	M1 A1	
8	**(a)**	$x : y = 1 : 2$ $= 3 : 6$ $y : z = 3 : 5$ $= 6 : 10$ $x : y : z = 3 : 6 : 10$	M1 A1	Award M1 for converting y to be the same number of units.
	(b)	<u>Size A:</u> \$8.90 ÷ 750 ml ≈ \$0.0119/ml <u>Size B:</u> \$4.90 ÷ 350 ml ≈ \$0.0140/ml Size <u>A</u> gives a better value because <u>the cost per milliliter (ml) is smaller</u> OR any equivalent reasoning.	M1 A1	Award M1 for correct computation of cost per volume for at least one size

9



(a) y-intercept = 4 B1

Gradient = −1 B1

(b) See grid above.

10 **(a)**

2	1350
3	675
3	225
3	75
5	25
5	5
	1

M1 Use of factor tree or repeated division

$1350 = 2 \times 3^3 \times 5^2$ A1

	(b)(i)	HCF $= 2 \times 3$ $= 6$	B1	
	(b)(ii)	LCM $= 2^2 \times 3^3 \times 5^2 \times 11$	B1	Accept LCM = 29700
	(b)(iii)	$k = 2^2 \times 5$ $= 20$	B1	
11	**(a)**	Total time $= 80 + 25 + 45$ $= 150$ min (or 2 h, 30 min) Time reached = 1:15pm **OR** 1315	M1 A1	
	(b)	Distance travelled $= 15 \times \frac{80}{60}$ $= 20$ km	M1 A1	
	(c)	Total distance travelled $= 20 + 5$ $= 25$ km		
		Total time taken $= \frac{80+25+45}{60}$ $= 2.5$ h		
		Average speed $= \frac{25}{2.5}$ $= 10$ km/h	M1 A1	Award M1 for concept of $\frac{\textit{total distance}}{\textit{total time}}$.
12	**(a)(i)**	Sum of interior angles $= (6-2) \times 180°$ $= 720°$	M1	
		$99 + 105 + 120 + (2x + 29) + (3x - 19) + (4x + 35) = 720$	M1	
		$9x = 351$ $x = 39$	A1	
	(a)(ii)	Largest interior angle $= 4(39) + 35$ $= 191°$	B1	
	(b)	Size of exterior angle $= 180 - 128$ $= 52°$		
		$n = \frac{360}{52°}$	M1	

		$= 6\frac{12}{13}$ Abbas is <u>wrong/ incorrect</u> since <u>*n* is not a positive integer</u> OR <u>*n* must be a positive integer</u> for a polygon to be regular OR any other equivalent reasoning.	A1	Do not award A1 explanation does not include "*n* must be a positive integer."
13	**(a)**	$\angle BDE = \angle ABD$ $= 56°$ $\angle BDE$ is 56° because $\angle BDE = \angle ABD$ (alt. $\angle$s, AB//DE).	B1 B1	Award B1 for correct reasoning.
	(b)	$\angle DCE = 180 - 112 = 68°$ (adj. $\angle$s on st. line*) Reflex $\angle DCE = 360 - 68 = 292°$ Reflex $\angle DCE$ is 292° because Reflex $\angle DCE = 360° - \angle DCE$ ($\angle$ at a point**).	M1 A1 B1	Award B1 for either * or ** or both reasoning given.
	(c)	$\angle CED = 180 - 68 - 56$ $= 56°$ ($\angle$ sum of Δ) ΔABC is an isosceles triangle because the base angles, $\angle$CED and $\angle BDE$ are equal.	M1 A1	Do not award A1 if $\angle$CED is correct but explanation is incorrect.

Paper 2				
1	(a)	$\text{Area} = \frac{1}{2}(8+14)(4) - \frac{1}{2}\pi(4)^2$ $= 18.9 \text{ cm}^2$ (3 s.f.)	M1 A1	
	(b)	Perimeter = 3 + 8 + 3 + 2(5) + $\pi(4)$ = 36.6 cm (3 s.f.)	M1 A1	
2	(a) (b) (c)	See Annex A	B2 B1 B1	B1 – Correctly drawn $\angle XWZ = 60°$ AND $WZ = 8$ cm B1 – Correctly drawn $\angle WXY = 90°$ AND $XY = 6$ cm
3	(a)	$T_6 = 7^2$	B1	
	(b)	$T_n = (n+1)^2$	B1	
	(c)	$(n+1)^2 = 225$ $n+1 = 15$ $n = 14$	M1 A1	Award M1 for taking square root on both sides
4	(a)	$p = 5$	B1	
	(b) (c)	See Annex A	B2 B1	B1 – correct scale and correctly labelled axes B1 – Straight line passes through all points
	(d)	Coordinates = (2 , 1)	B1	
5	(a)	$\frac{x+4}{2} - \frac{5(x-1)}{3}$ $= \frac{x+4}{2} - \frac{5x-5}{3}$ $= \frac{3(x+4)-2(5x-5)}{6}$ $= \frac{3x+12-10x+10}{6}$ $= \frac{22-7x}{6}$	M1 M1 A1	Award M1 for correct LCM for denominator Award M1 for correct expansion of numerator

	(b)	$\frac{2y+5}{3} = \frac{2(7-y)}{5}$ $5(2y+5) = 6(7-y)$ $10y+25 = 42-6y$ $16y = 17$ $y = 1\frac{1}{16}$	M1 A1	Award M1 for cross-multiplication
6	**(a)**	$n+3,\ n+5$	B2	
	(b)	Sum $= (n+1)+(n+3)+(n+5)$ $= 3n+9$	 B1	
	(c)	$3n+9 = 333$ $3n = 324$ $n = 108$	M1 A1	
7	**(a)**	Wages $= \frac{1200}{3+4+5} \times 4$ $= \$400$	 B1	
	(b)	Manufacturing cost $= \frac{1480}{125} \times 100\%$ $= \$1184$	M1 A1	
	(c)	Original Ratio = 1 : 2: 3 New Ratio = 2 : 4 : 3 Percentage increase $= \frac{9-6}{6} \times 100\%$ $= 50\%$	M1 M1 A1	Award M1 for finding the new ratio
8	**(a)**	Volume of block = Vol of prism − Vol of cylinder $= (11\times 6)\times 15 - \pi(3)^2(15)$ $= 990 - 135\pi$ $= 566\ \text{cm}^3$ (3 s.f.)	M1 A1	
	(b)	Total surface area $= \text{Area}_{\text{lateral faces}} + \text{Area}_{\text{cylinder}} + 2\times\text{Base Area}$ $= 2(8\times 15)+2(11\times 15)+\left[2\times(11\times 6)-2(\pi\times 3^2)\right]+$ $2\pi(3)(15)$ $= 928.1946711$ $= 928\ \text{cm}^2$ (3 s.f.)	 M1 M1 M1 A1	Award M1 for finding 4 lateral faces, M1 for finding the curved SA_{cylinder} & M1 for finding the base area (parallelogram – circle)

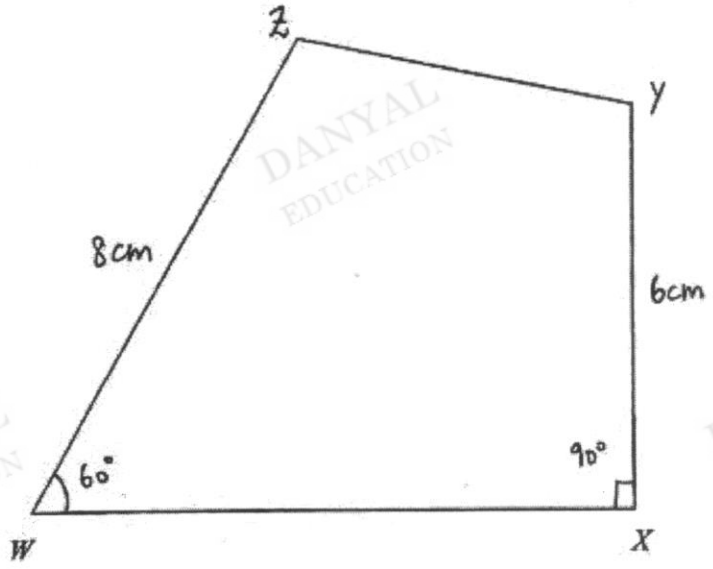
	(c)	Volume of cube $= (990-135\pi)\text{ cm}^3$ Length of cube $= \sqrt[3]{990-135\pi}$ $= 8.271343$ cm Total surface area $= 8.271343^2 \times 6$ $= 410\text{ cm}^2$ (3 s.f.)	 M1 M1 A1	Allow ECF Award M1 for finding the length of cube. Award M1 for finding surface area of one face of the cube
9	(a)	Time taken $= \frac{19}{70} \times 60$ $= 16.285$ ≈ 16 min (correct to nearest min)	M1 A1	Award M1 for correct use of formula to find time.
	(b)	Amount $= 2.50 + (19 \times 0.50) + (16.285 \times 0.16)$ $= \$14.61$ (2 d.p.)	B1	Award B1 if student uses *time* = 16 min and obtain *amount* = $14.56
	(c)	Time taken = 16 + 5 = 21 min **Comeford** Amount payable = [Flag down fare + Dist fare (1st 10 km) + Dist fare (next 10 km)] × Peak hr surcharge $= \left[3.20 + \left(\frac{10000}{400} \times 0.22\right) + \left(\frac{9000}{300} \times 0.15\right)\right] \times 1.25$ $= \$16.50$	 M1 M1	 Award M1 for base fare and M1 for including 25% surcharge
		Greb Amount payable = Base fare + Dist fare + Timing fare $= 2.50 + (19 \times 0.50) + (21.285 \times 0.16)$ $= \$15.41$	 M1	 Award M1 for calculating new peak hour Greb fare
		Mrs Lim should choose Greb because her transportation cost is lesser/cheaper and therefore more economical **OR** any equivalent explanation.	A1 A1	Award M1 if student uses *time* = 21 min and obtain *amount* = $15.36 for calculating Greb fare

Annex A

2 (a) Construct a quadrilateral $WXYZ$ where $WX = 9$ cm, $XY = 6$ cm, $WZ = 8$ cm, $\angle XWZ = 60°$ and $\angle WXY = 90°$. The line WX has been drawn for you. [2]

SOLUTION:

B1 – Correctly drawn $\angle XWZ = 60°$ AND $WZ = 8$ cm
B1 – Correctly drawn $\angle WXY = 90°$ AND $XY = 6$ cm



6 (b)