



PEICAI SECONDARY SCHOOL
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
PRELIMINARY EXAMINATION 2020

CANDIDATE
NAME

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CLASS

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REGISTER NUMBER

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MATHEMATICS

Paper 1

4048/01

28 August 2020

2 hours

Candidates answer on Question Paper

READ THESE INSTRUCTIONS FIRST

Write your register number, class and name 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 number of marks for this paper is 80.

	AN notations	AC curacy
Marks Deducted	3	1

For Examiner's Use

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This document consists of 21 printed pages and 3 blank pages.

Setter: Mrs Ho Thuk Lan

[Turn over

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

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

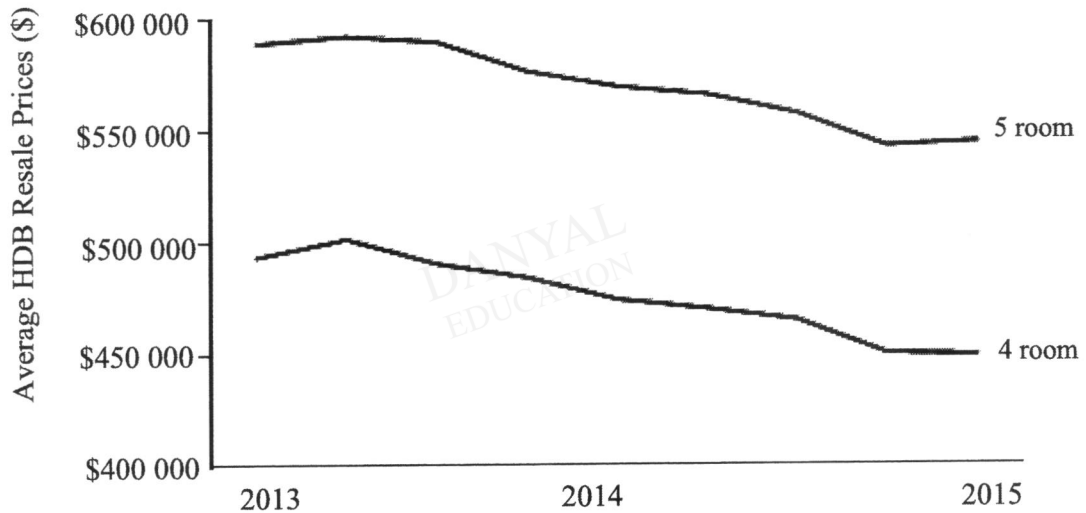
$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** questions

- 1 The weight, w , of a fridge is 100 kg correct to the nearest ten.
Write down an inequality for the weight of the fridge.

Answer [1]

- 2 Average resale price of 4 room and 5 room HDB flats from 2013 to 2015



Source: PropertyGuru Research, HDB

Mr Pang says that the price of a resale 5 room flat is thrice the price of a resale 4 room flat in 2015.

Is Mr Pang correct? Explain.

.....

.....

.....

.....[1]

- 3 (a) Simplify $15m^2n^{-2} \div 3mn^2$.

Answer [1]

- (b) Given that $5^{-3} \times 5^p = 1$, write down the value of p .

Answer p = [1]

- 4 (a) Express 7056 as a product of its prime factors.

Answer [1]

- (b) Using your answer to part (a), explain why 7056 is a perfect square.

.....
 [1]

- 5 The population of Singapore increased from 1.96×10^6 in 1967 to 5.8×10^6 in 2019. The number increased by $r\%$ every year. Find the value of r .

Answer $r = \dots\dots\dots$ [2]

- 6 Write as a single fraction $\frac{2}{3x-1} - \frac{1}{2x+1}$.

Answer $\dots\dots\dots$ [2]

- 7 A swimming pool has an inlet pipe and a drainage pipe. The inlet pipe can fill up the swimming pool in 3 hours. The drainage pipe can completely drain the water in the pool in 4 hours.
Find the time taken to fill up the swimming pool if the drainage pipe is left open.

Answer hours [2]

- 8 Mrs Tan makes a fruit punch using orange juice, pineapple juice and Sprite.
The ratio orange juice : Sprite is 3 : 5
The ratio Sprite : pineapple juice is 2 : 3
- (a) Find the ratio orange juice : Sprite : pineapple juice.

Answer : : [1]

- (b) She uses 1.5 litres of Sprite.
How much fruit punch does she make altogether.

Answer litres [1]

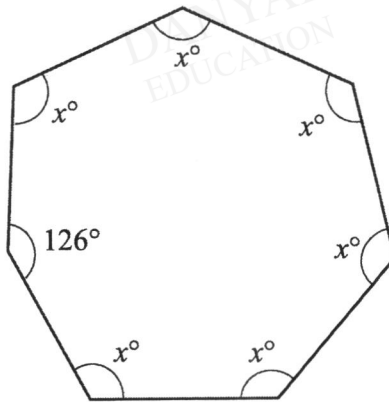
- 9 (a) Factorise $4x^2 - y^6$.

Answer [1]

- (b) Factorise completely $xy + 3y - 5x - 15$.

Answer [2]

- 10 An 7-sided polygon has six interior angles measuring x° each.
The remaining interior angle is 126° .



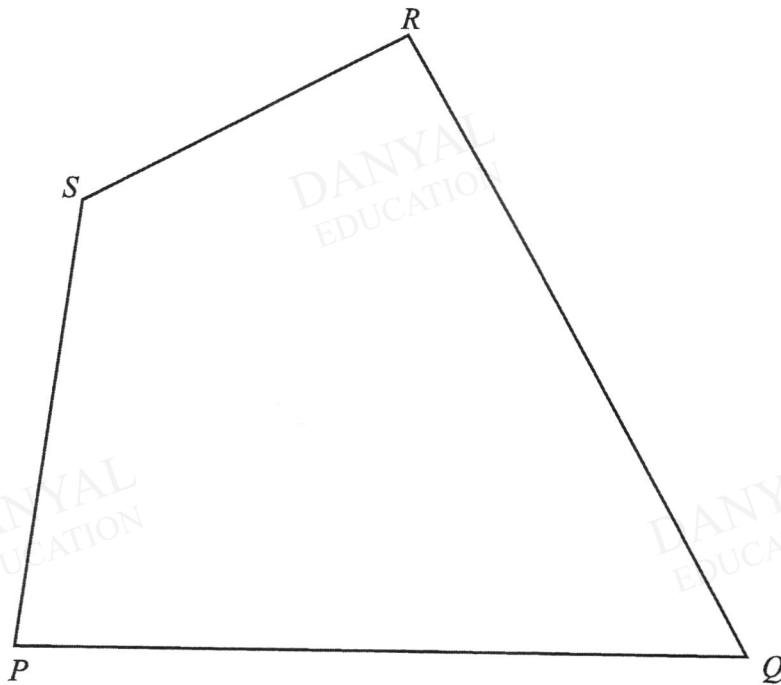
- (a) Draw the line of symmetry on the diagram.
(b) Find the value of x .

[1]

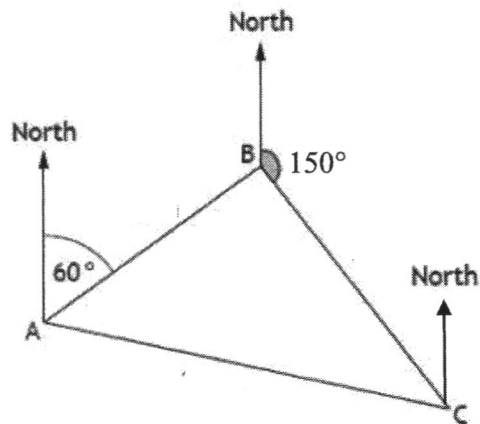
Answer $x =$ [2]

11 The diagram shows a quadrilateral $PQRS$. On the diagram,

- (a) construct the bisector of angle PQR , [1]
- (b) construct the perpendicular bisector of line PS , [1]
- (c) mark and label clearly the points M and N inside the quadrilateral $PQRS$ that is 7 cm from point R and is also equidistant from P and S . [1]



12



A ship travels from A to B on a bearing of 060° and then from B to C on a bearing of 150° . The bearing of A from C is 290° .

- (a) Find the bearing of A from B .

Answer $^\circ$ [1]

- (b) Find angle BAC .

Answer $^\circ$ [2]

- 13 (a) Mr Lee drove for 6 hours at an average speed of x km/h and then for 10 hours at an average speed of y km/h.
He drove a total distance of 1304 km.
Write down an equation in terms of x and y and show that it simplifies to

$$3x + 5y = 652.$$

Answer

[1]

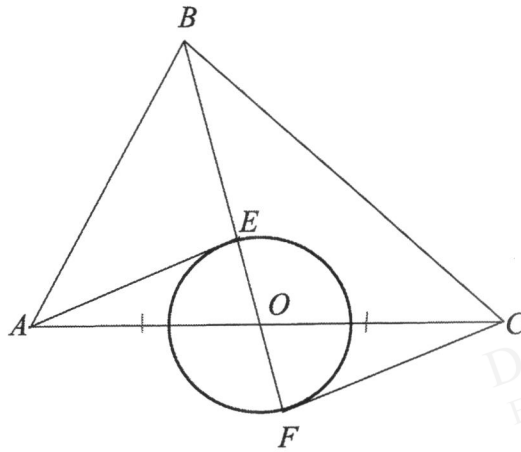
- (b) Mr Pang drove for 4 hours at an average speed of x km/h and then for 6 hours at an average speed of y km/h.
He drove a total distance of 816 km.
Write down an equation, in terms of x and y , to represent this information.

Answer [1]

- (c) Solve the two equations to find the value of x and of y .

Answer $x = \dots\dots\dots$, $y = \dots\dots\dots$ [2]

- 14 In the diagram, $OA = OC$, AE and FC are tangents to the circle with centre O . OE and OF are radii of a circle. BF is a straight line passing through point E and O .



- (a) Show that triangle OAE and triangle OCF are congruent. Give a reason for each statement you make.

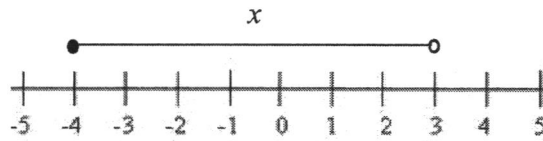
Answer

[3]

- (b) Points, P and Q lie on the circumference of the circle such that triangle APE is congruent to triangle CQF . On the diagram, mark the positions for the points, P and Q .

[1]

- 15 (a) A range of values for x is represented on the number line below.



Write down inequalities that represent this range of values of x .

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Answer [1]

- (b) (i) Solve the inequality $\frac{5-x}{3} > x+1$.

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Answer [2]

- (ii) Hence state the largest integer of x .

Answer $x =$ [1]

- 16 $\mathcal{E} = \{\text{integers } x : 4 < x \leq 11\}$
 $A = \{\text{multiples of } 5\}$
 $B = \{\text{prime numbers}\}$

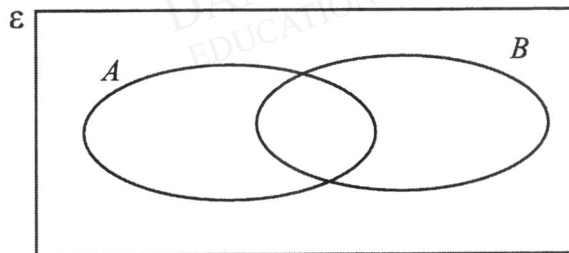
(a) List the elements contained in the set $(A \cup B)'$.

Answer [1]

(b) List the elements contained in the set $A \cap B'$.

Answer [1]

(c) On the Venn diagram, shade the region which represents $A' \cap B'$.



[1]

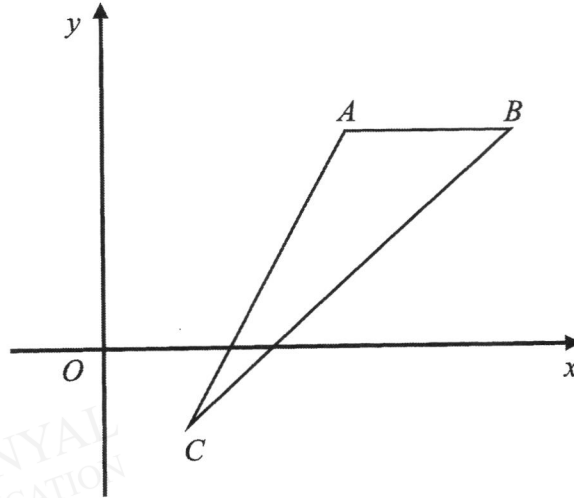
(d) $C = \{\text{negative integers}\}$

Complete the statement using set notations.

$A \cap C = \dots\dots\dots$

[1]

- 17 The points A , B and C are $(9, 8)$, $(15, 8)$ and $(4, -2)$ respectively.



Find

- (a) the gradient of AC ,

Answer [1]

- (b) the equation of the line which passes through $(0, 5)$ and is parallel to AC ,

Answer [1]

- (c) the length of AC ,

Answerunits [1]

- (d) the value of $\cos \angle BAC$.

Answer $\cos \angle BAC = \dots\dots\dots$ [1]

- 18 A factory supplies coffee beans to shop *A*, *B* and *C*.
 The matrix, **P**, shows the number of bags of 5 kg, 10 kg and 15 kg sold to to shop *A*, *B* and *C*.

$$P = \begin{matrix} & \begin{matrix} 5\text{kg} & 10\text{kg} & 15\text{kg} \end{matrix} \\ \begin{pmatrix} 20 & 50 & 30 \\ 40 & 60 & 20 \\ 30 & 20 & 50 \end{pmatrix} & \begin{matrix} \text{Shop } A \\ \text{Shop } B \\ \text{Shop } C \end{matrix} \end{matrix}$$

The factory delivers the coffee beans to shop *A*, *B* and *C* three times yearly.

- (a) Evaluate the matrix **S** = 3**P**.

Answer S = [1]

- (b) The cost of 5 kg, 10 kg and 15 kg bags are \$9.50, \$12.60 and \$23 respectively. Represent the prices of the coffee beans in a 3 × 1 column matrix **Q**.

Answer Q = [1]

- (c) Evaluate the matrix **T** = **SQ**.

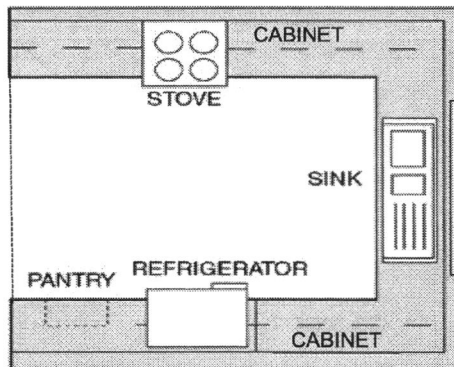
Answer T = [2]

- (d) State what each of the elements of **T** represents.

.....

[1]

- 19 The diagram shows the actual floor plan of Mr Koh's rectangular kitchen. It is drawn to a scale of 1cm represents n metres.




The actual area of the floor is 124 m^2 .

- (a) Use the plan to find the value of n , correct to the nearest integer.

Answer $n = \dots\dots\dots$ [2]

- (b) Mr Koh decides to lay tiles on the kitchen floor before the installation of the cabinets, stove, sink and refrigerator. The dimensions and cost of one square tile are shown below.



Dimension of tile
0.5 m by 0.5 m
Cost per tile = \$8

Using your answer in part (a), find

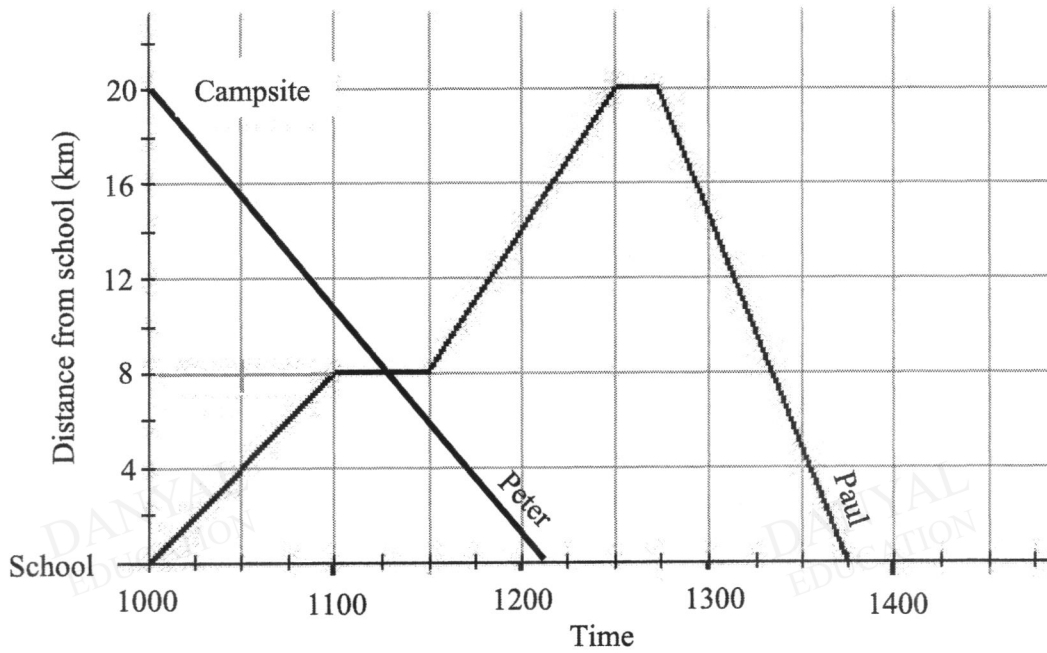
- (i) the number of tiles needed,

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

- (ii) the cost of buying the tiles.

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

20



The distance-time graph shows the journeys for Peter and Paul between school and campsite.

(a) Find Paul's speed at 12 pm.

Answer km/h [2]

(b) (i) Find the time when Peter and Paul meet each other.

Answer [1]

(ii) How far are they from the Campsite when they meet each other.

Answer km [1]

(c) How long did Paul stay at the Campsite?

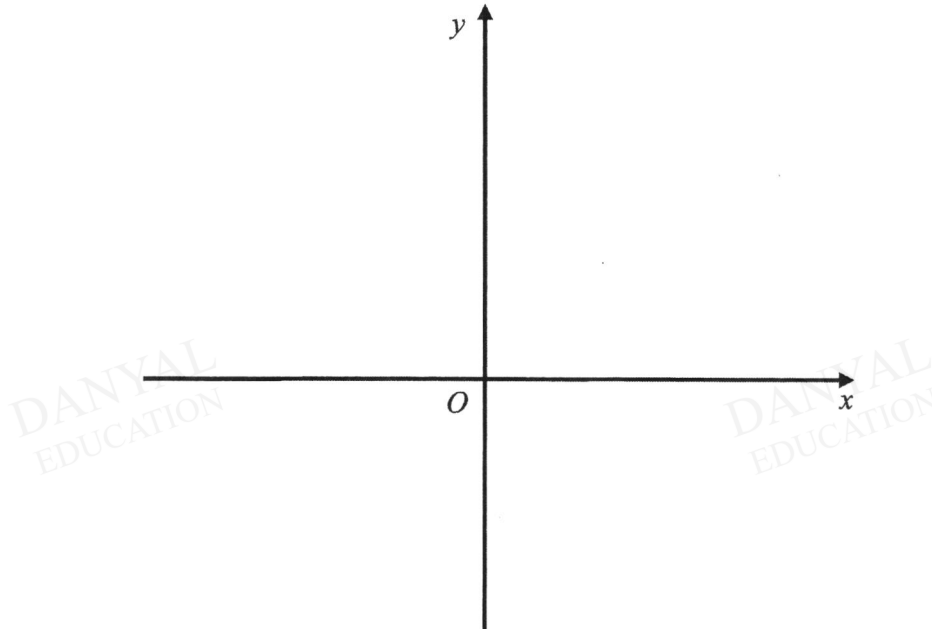
Answer minutes [1]

(d) Find Paul's speed at 10.30 am in metres per second.

Answer m/s [1]

- 21 (a) **Sketch** the graph of $y = -(x+2)(x-4)$ on the axes below.

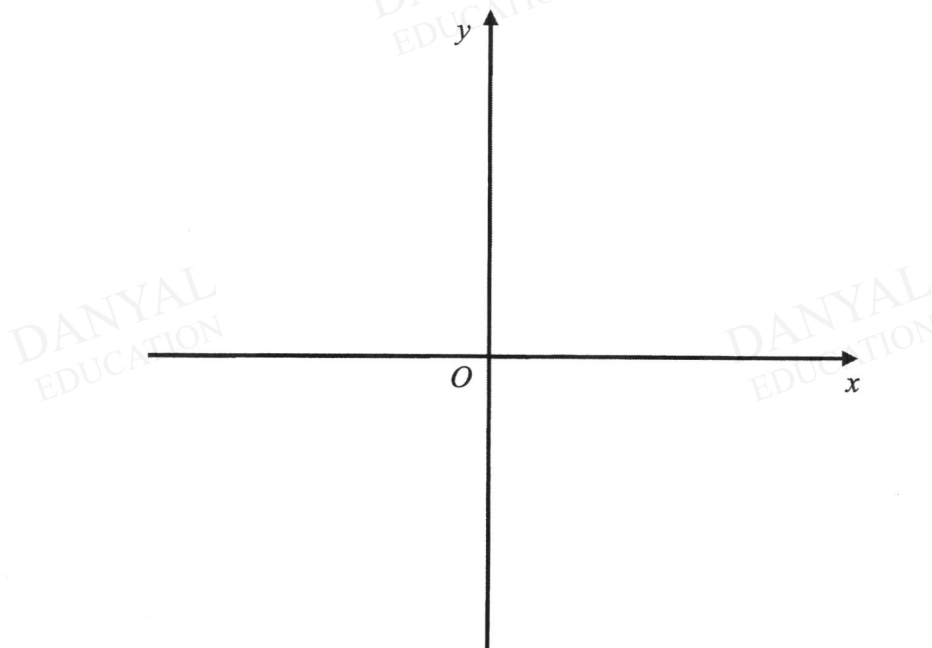
Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve.



[3]

- (b) **Sketch** the graph of $y = (x-2)^2 - 1$ on the axes below.

Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve.



[2]

- (c) Write down the equation of the line of symmetry of $y = (x-2)^2 - 1$

Answer [1]

22 A bag contains 8 buttons, n of which are white and the rest are black.

A button is chosen at random and not replaced.

(a) Write down, in terms of n , the probability that the button is black.

Answer [1]

A second button is chosen at random.

(b) Find, in terms of n , the probability that both buttons are black.

Answer [1]

(c) (i) The probability that both buttons are black is $\frac{3}{28}$.

Show that $n^2 - 15n + 50 = 0$.

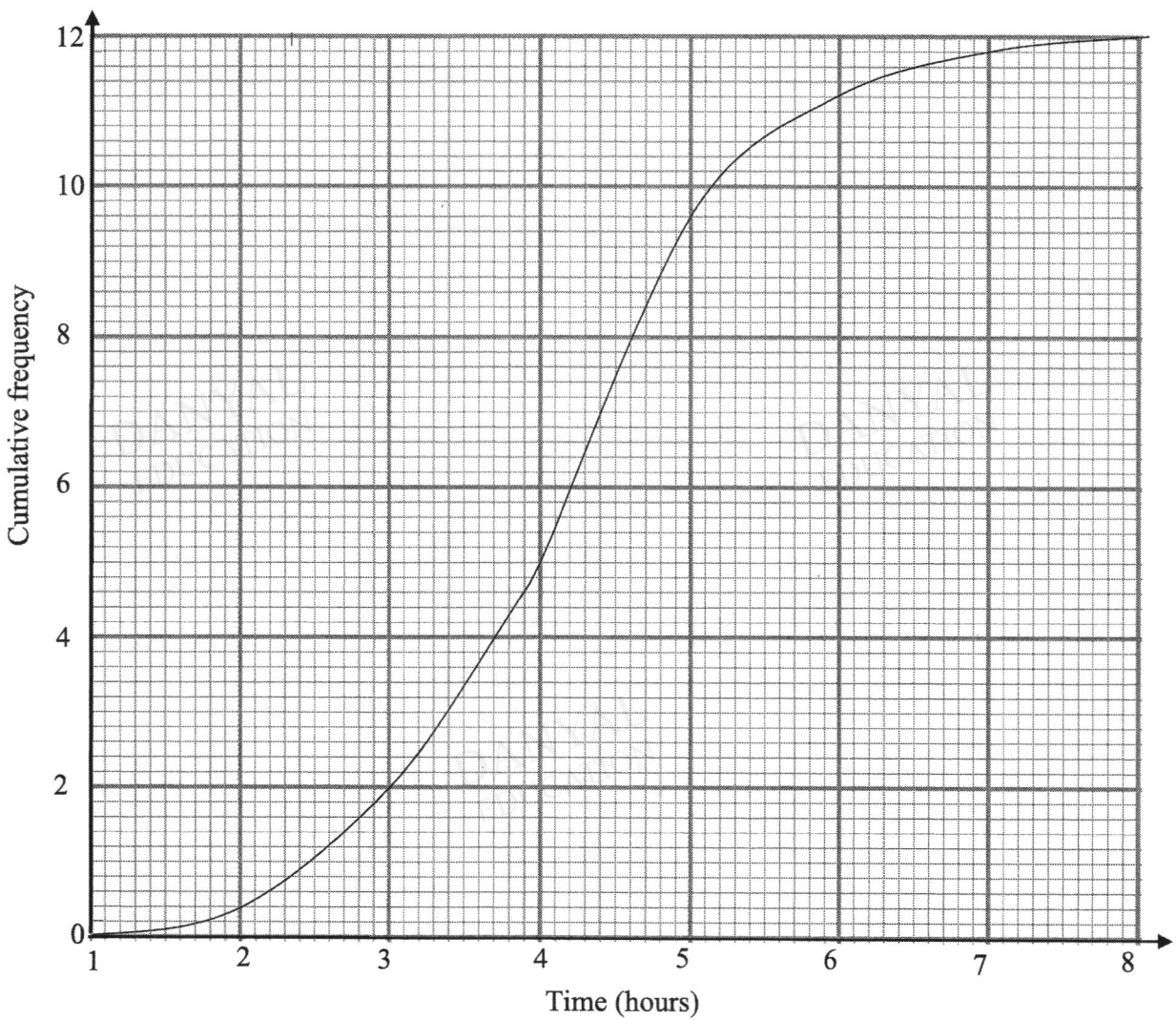
Answer

[2]

(ii) Solve the equation $n^2 - 15n + 50 = 0$ to find the number of black buttons in the bag.

Answer buttons [3]

- 23 The cumulative frequency curve shows the time spent by 12 students from school *A* on mobile phones on a particular Sunday



(a) Use the graph to find

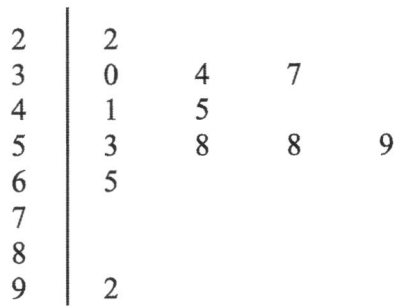
(i) the median time spent on mobile phone,

Answer h [1]

(ii) the interquartile range.

Answer h [2]

The stem-and-leaf diagram shows the time spent by 12 students from school *B* on mobile phones on a particular Sunday



Key: 2 | 2 represents 2.2 hours

(b) Find the median time spent on mobile phone,

Answer h [1]

(c) Explain why the mean may not be an appropriate average to use to summarise the time spent by these students on mobile phone.

Answer

.....

.....[1]

(d) Make one comparison on the time spent by students on mobile phones.

Answer

.....

.....[1]



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PRELIMINARY EXAMINATION 2020

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MATHEMATICS

Paper 2

4048/02

31 August 2020

2 hours 30 minutes

Candidates answer on Question Paper

READ THESE INSTRUCTIONS FIRST

Write your register number, class and name 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 number of marks for this paper is 100.

	AN notations	AC curacy	U nits
Marks Deducted	3	1	1

For Examiner's Use

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This document consists of **26** printed pages and **2** blank pages.

Setter: Mr Caleb Chan and Mr Lee Jia Hao

[Turn over

*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** questions

1 Given that $s = ut + \frac{1}{2}at^2$.

(a) Find s when $u = 0$, $a = 0.6$ and $t = 15$. [1]

(b) Express a in terms of s , u and t . [2]

2 (a) Express $x^2 - 9x + 17$ in the form of $(x + a)^2 + b$. [1]

(b) Hence, solve the equation $x^2 - 9x + 17 = 0$, giving your answers correct to two decimal places. [2]

- 3 The gravitational force, F , between two objects is inversely proportional to the square of the distance, d , between them.

The distance between the objects decreased by 75%.
Calculate the percentage increase in the gravitational force.

[4]

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- 4 John buys a computer on hire purchase, which includes the initial deposit and monthly instalments. After the initial deposit, he pays a remainder of 18 equal monthly instalments of \$127.72 each.

(i) How much was the total monthly instalments John paid? [1]

(ii) The total monthly instalments is inclusive of a simple interest of 3% per annum. Find the remaining amount before interest was charged. [2]

(iii) John initially paid a 20% deposit for it. Find the price of the computer. [1]

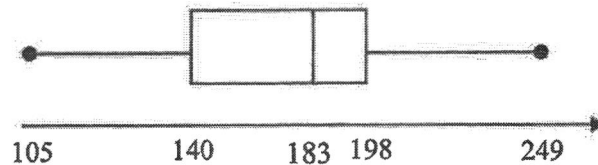
- 5 The table below shows the distribution of the PSLE T-scores of the Secondary One cohort in 2019.

T-Score (x)	Frequency
$100 < x \leq 150$	68
$150 < x \leq 200$	84
$200 < x \leq 250$	96

- (i) Calculate the mean for the 2019 cohort. [1]

- (ii) Calculate the standard deviation for the 2019 cohort. [1]

The diagram below shows the distribution of the PSLE T-scores of the Secondary One cohort in 2020.



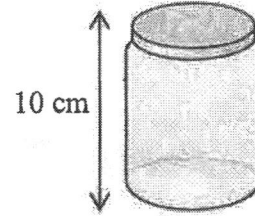
- (iii) The Principal claims that by comparison the 2020 cohort performed better than the 2019 cohort. Do you agree with the comparison made by the Principal? Explain your answer. [1]

6 (a) Factorise completely $32k^2 - 18$. [2]

(b) Simplify $\frac{32k^2 - 18}{4k^2 + 7k + 3}$. [2]

7 Solve the equation $\frac{x-7}{2x-5} + \frac{2}{5-2x} = -\frac{1}{4}$. [4]

8

**Container A****Container B****Container C**

You are given the following information:

1. Containers A, B and C are geometrically similar.
2. Container A's volume is 8 times of Container C's volume.
3. The ratio of Container B's surface area to Container C's surface area is 9:4.

Find the difference in height of Container A and Container B.

[4]

- 9 The first four terms in a sequence of numbers are given below.

$$T_1 = 1^2 \times 91 = 91$$

$$T_2 = 2^2 \times 84 = 336$$

$$T_3 = 3^2 \times 77 = 693$$

$$T_4 = 4^2 \times 70 = 1120$$

- (a) Find T_5 .

[1]

- (b) Show that the n th term of the sequence is given by the formula $-7n^3 + 98n^2$.

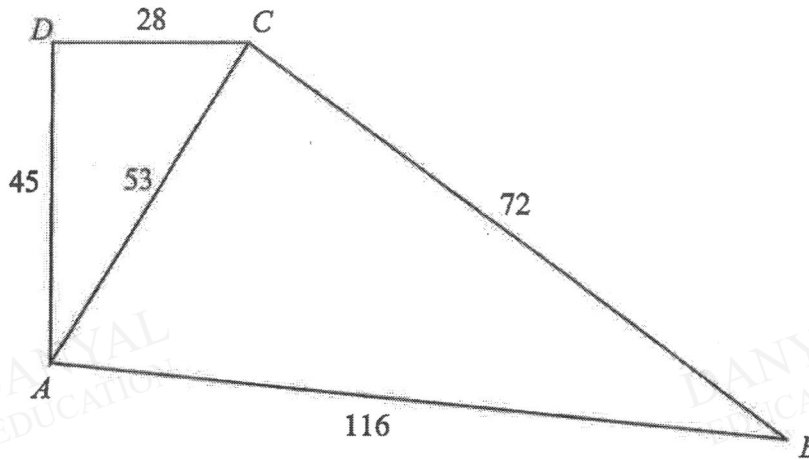
[2]

- (c) Mr. Tan claims that 0 is a term of this sequence.
Do you agree with him? Justify your answers with mathematical reasons.

[2]

10 The diagram shows the walking paths of a field $ABCD$ on horizontal ground.

$AB = 116\text{ m}$, $BC = 72\text{ m}$, $CD = 28\text{ m}$, $AD = 45\text{ m}$ and $AC = 53\text{ m}$.



(a) Show that angle $ADC = 90^\circ$.

[2]

(b) Find the value of angle BAC .

[3]

(c) A tower T stands vertically on C . The angle of depression of B when viewed from top of the tower is 11.77° .

(i) Find the height of tower T . [2]

(ii) Find the area of triangle ABC . [2]

(ii) Using your answer to (c)(i) and (c)(ii), calculate the greatest angle of elevation of the top of the tower from a person walking from A to B .

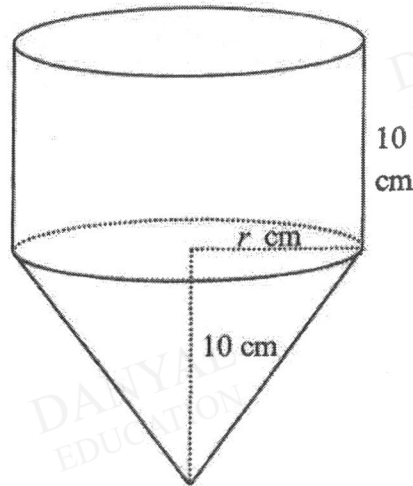
[3]

- 11 A bag contains five counters, numbered 1, 2, 3, 4, and 5. Two counters are taken from the bag at random, one after the other, **without replacement**.
- (i) Draw a possibility diagram to represent the outcomes. [1]
- (ii) Find, in the simplest form, the probability that
- (a) both counters have a number less than 3, [1]
- (b) neither counter has an even number, [1]
- (c) the sum of the numbers is 10, [1]
- (d) the product of the numbers is less than 6. [1]

12 (a) Express 20 m/s in km/h.

[2]

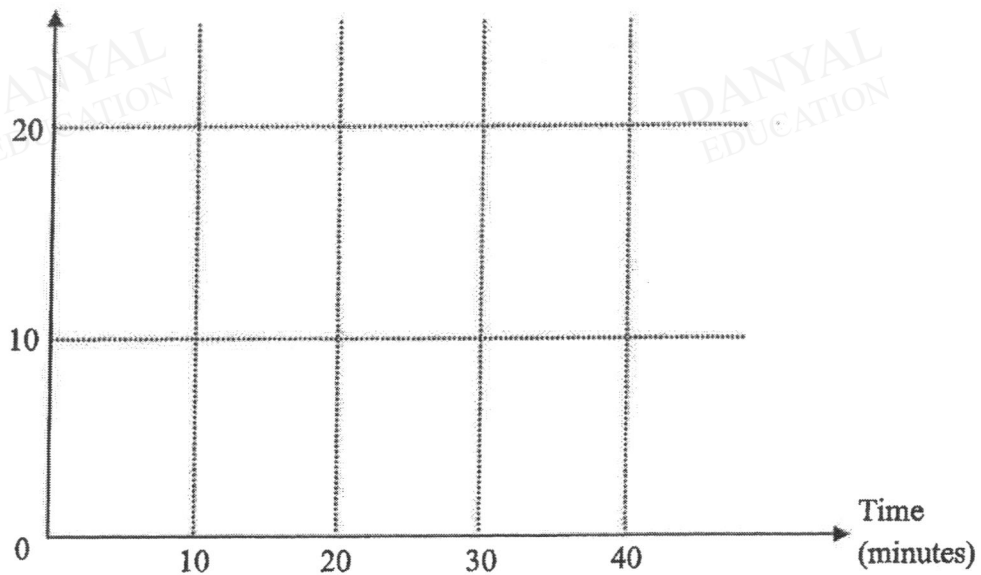
- (b) The container below is made up of a cylinder and a cone, both with a radius of r cm and a height of 10 cm. Water is being poured into the container at a constant rate. It took 40 minutes for the container to be completely filled to the brim.



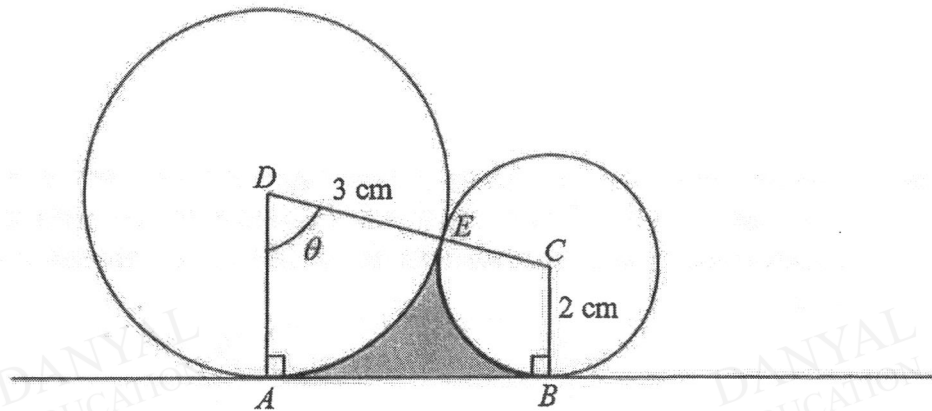
In the axes below, sketch the graph showing how the depth of water in the container varies with time.

[3]

Depth of water (cm)



- 13 The diagram below shows two circles with centres C and D with radii 2 cm and 3 cm respectively. The circles only touch at point E and are tangent to the line AB .



- (a) Explain why AD is parallel to BC . [1]

- (b) Show that $\theta = 1.369$ radians. [2]

(c) Find the perimeter of the shaded region.

[4]

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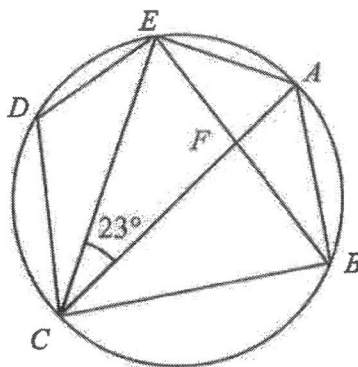
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- 14 (a) In the diagram, A, B, C, D and E are points on the circle. AC is the diameter and $\angle ACE = 23^\circ$.



Calculate, giving reasons for each answer,

(i) $\angle EBA,$

[1]

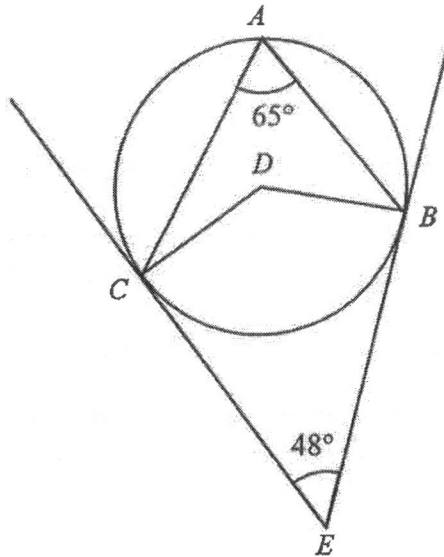
(ii) $\angle EBC,$

[1]

(iii) $\angle CDE.$

[1]

- (b) The diagram below shows a circle with points A , B and C on its circumference. The lines EC and EB are tangents to the circle. The point D is inside the circle. Angle $CAB = 65^\circ$ and angle $CEB = 48^\circ$



Determine if the point D is the centre of the circle.
Give reasons for your answer.

[4]

- 15 The height of a roller coaster in the first 4.5 seconds of its motion is recorded in the table below. The time, t , is measured in seconds while its corresponding height, h , is measured in metres.

t (s)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5
h (m)	40	44	46.1	44	40	31.4	20.7	10.6	5.87	10.6

- (a) Complete the whole of this part of the graph on the next page.

Using a scale of 2 cm to 0.5 unit, draw a horizontal t -axis for $0 \leq t \leq 4.5$.
Using a scale of 2 cm to 5 units, draw a vertical h -axis for $0 \leq h \leq 50$.

Plot the points in the table above and connect them in a smooth curve. [3]

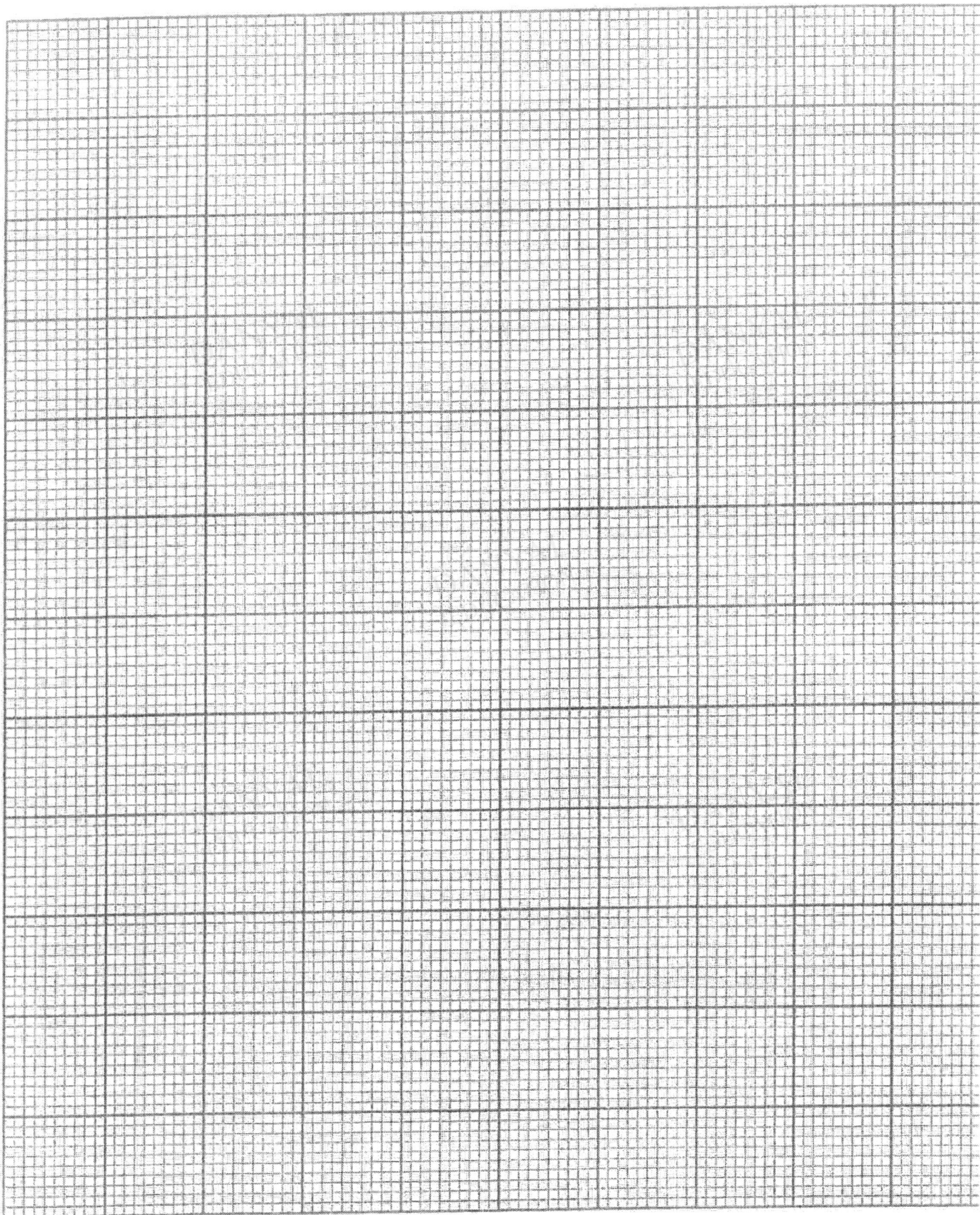
- (b) The minimum safety requirement of the rollercoaster is to be at least 5 m above the ground. Use your graph to determine if the rollercoaster meets the safety requirement. [1]

- (c) Use your graph to find the height of the rollercoaster at 0.75 seconds of its motion. [1]

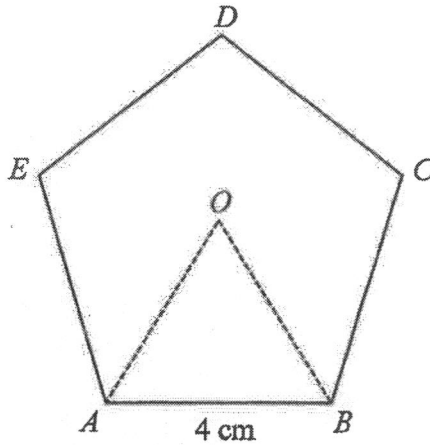
- (d) (i) By drawing a tangent, find the gradient of the curve at $t = 2$. [2]

- (ii) What does this gradient represent? [1]

- (iii) Use your graph to find the time when the rollercoaster descends at the same rate. [1]



- 16 The diagram below shows a regular pentagon $ABCDE$ of sides 4 cm and centre O .

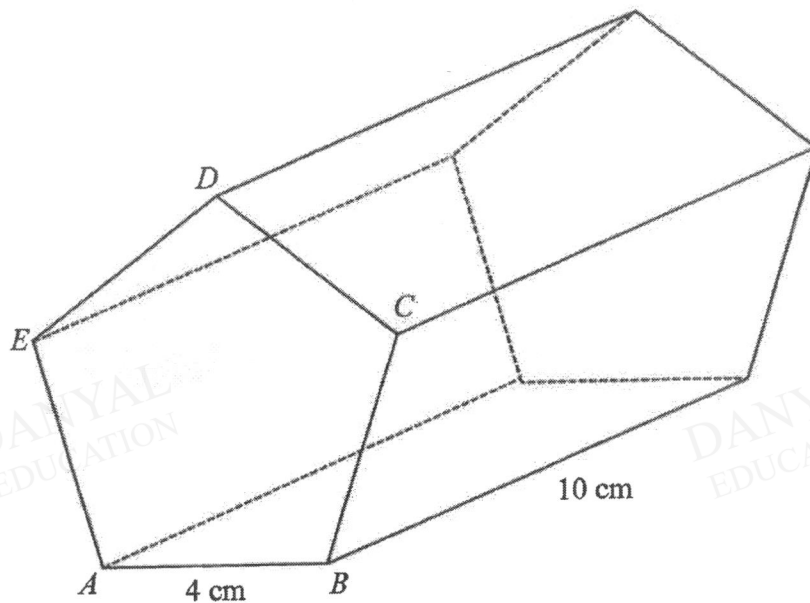


- (a) (i) State the value of angle AOB . [1]

- (ii) Show that $OA = 3.4026$ cm. [3]

- (iii) Hence, find the area of pentagon $ABCDE$. [2]

The figure below shows a pentagonal prism with cross-section $ABCDE$ and length 10 cm.



- (b) Using your answer from (a)(iii), find the volume of the prism. [1]

- (c) Mr. Chin wants to paint 100 pieces of the prism above with a budget of \$130. Given that each 5-litre can of paint costs \$24.99, explain whether Mr. Chin's budget is sufficient. Show all mathematical calculations clearly. [4]



- 17 Mr. and Mrs. Tan decided to bring their two children of age 8 and 12 years-old to Bali during December holiday, from 1 December 2020 to 3 December 2020.

Mr. Tan found the following two flights information from www.skyscanner.com.

Option A:

	10:30 SIN	2h 50 Direct	→	13:20 DPS	7 deals from \$229 \$916 total Select →
	22:20 DPS	2h 40 Direct	→	01:00 ⁺¹ SIN	

Option B:

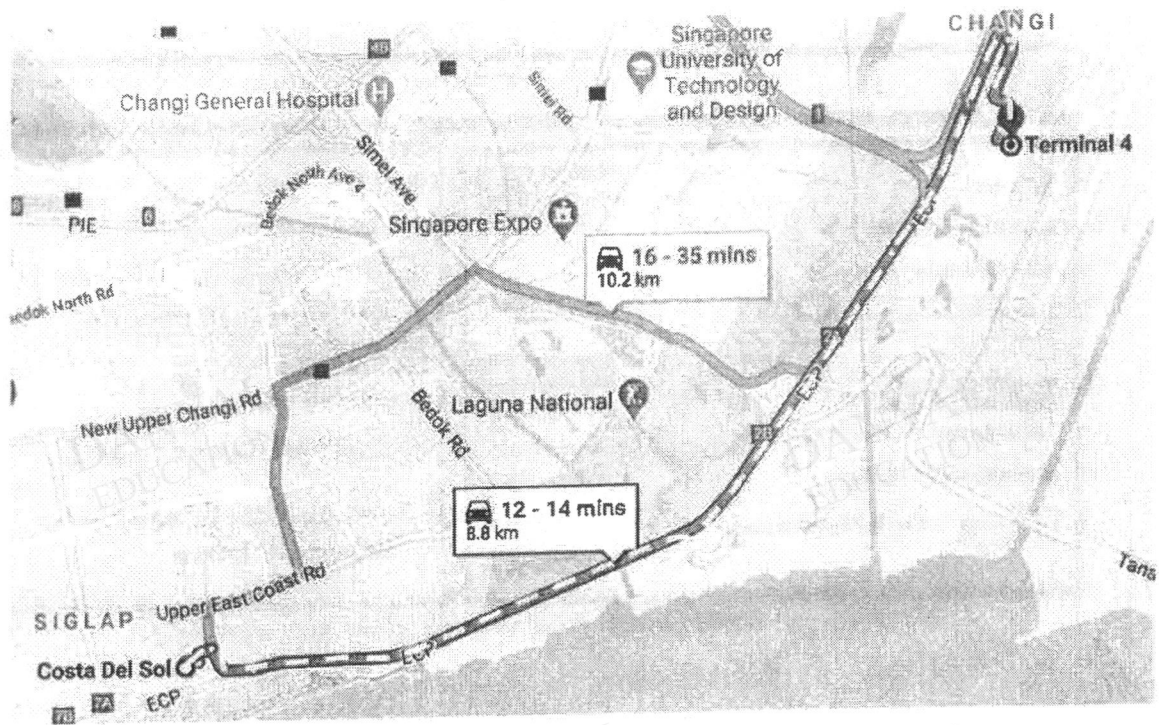
	15:20 SIN	2h 46 Direct	→	18:05 DPS	7 deals from \$229 \$916 total Select →
	22:20 DPS	2h 40 Direct	→	01:00 ⁺¹ SIN	

Mr. Tan would like to reach Bali Denpasar (DPS) International Airport by 4 pm.

- (a) Which Option will you advise Mr. Tan to choose? Justify your answer.

[1]

- (b) According to Google Maps, Changi Airport Terminal 4 is 8.8 km away from their home at Costa Del Sol using the East Coast Parkway (ECP).



Using the information provided by Google Maps, calculate the **minimum average speed in km/h** of the taxi traveling from Coasta Del Sol to Changi Airport Terminal 4 using the East Coast Parkway (ECP).

[2]

Mr. Tan found the following information online while planning for the holiday. The family intends to stay in one of the two accommodation below and visit the waterpark, Waterbom.

The screenshot shows two accommodation options on Agoda.com for Bali, from Dec 1 to Dec 3, 2020, for 2 adults and 2 children.
Bali Rani Hotel (2019): Excellent location, Convenient city access, Breakfast, Free cancellation, Pay at the hotel, +1. Lowest price includes Free breakfast. Exceptional price for your family at this location. Recommended by 94% of guests. 24HOURS SALE: Coupon Code 24HOURSALe applied - SG-. Price per night as low as **378** (MEGA SALE) **SGD 131**.
(2019) Bintang Bali Resort: Excellent location, Convenient city access, Breakfast, Free cancellation, Pay at the hotel, +2. Lowest price includes Free breakfast. Recommended by 87% of guests. 24HOURS SALE: Coupon Code 24HOURSALe applied - SG-. **25% discount for Waterbom Admission Tickets!** Price per night as low as **559** (MEGA SALE) **SGD 148**.
 Both hotels have 'Excellent' ratings: 8.2 for Bali Rani Hotel and 8.0 for Bintang Bali Resort.

Figure 1. Accommodation information from www.agoda.com.

The screenshot displays the 'SINGLE DAY PASS' for Waterbom, which includes 1 day access to all slides till 6 pm. The start price is IDR 327,000. There are three ticket categories with their respective prices and quantity controls:
CHILD (2-11 years old): IDR 327,000
ADULT: IDR 455,000
FAMILY (2 Adults, 2 Children (2-11 years old)): IDR 1,435,000

Figure 2. Waterbom Admission Ticket prices.

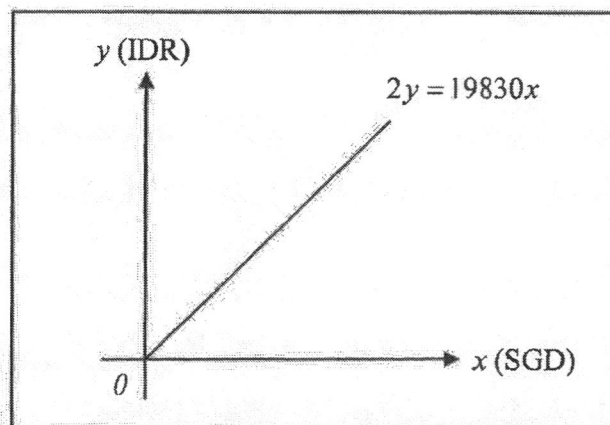


Figure 3. Exchange Rate between Singapore Dollars (SGD) and Indonesian Rupiah (IDR).

- (c) (i) The exchange rate between SGD and IDR is in the form
IDR 1000 = SGD k .

State the value of k .

[1]

- (ii) Mr Tan intends to book the accommodation for 2 nights and purchase the Waterbom admission tickets online.

Will both accommodation allow him to **keep the total cost** (excluding food and transportation) under SGD \$430?

Justify your answer and show your calculations clearly.

(You may continue your working in the next page if needed)

[6]

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PEICAI SECONDARY SCHOOL
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC
PRELIMINARY EXAMINATION 2020

CANDIDATE
NAME

CLASS

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REGISTER NUMBER

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MATHEMATICS

Paper 1

MARKSCHEME

4048/01

28 August 2020

2 hours

Candidates answer on Question Paper

READ THESE INSTRUCTIONS FIRST

Write your register number, class and name 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 number of marks for this paper is 80.

	AN notations	AC curacy
Marks Deducted	3	1

For Examiner's Use

--

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

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

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

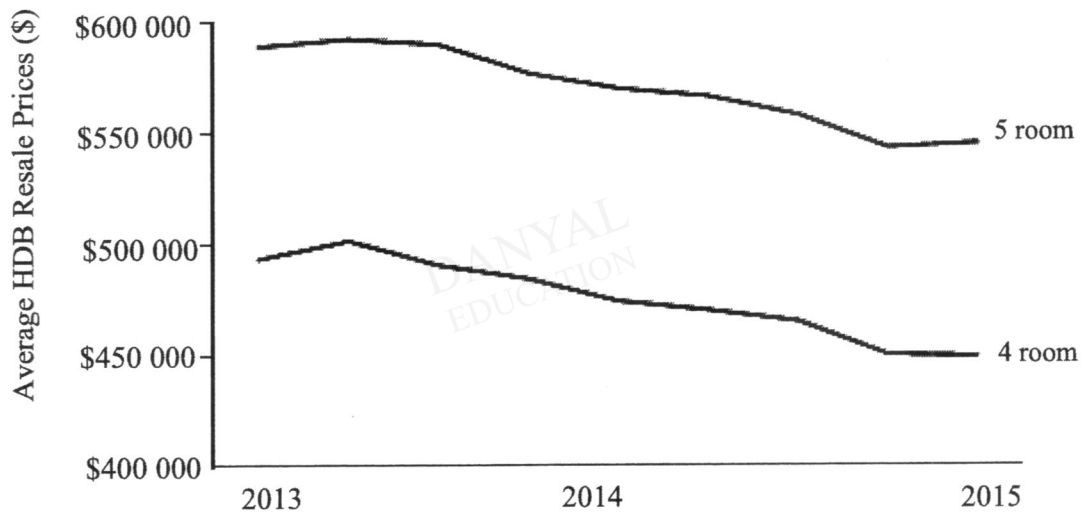
Answer **all** questions

- 1 The weight, w , of a fridge is 100 kg correct to the nearest ten.
Write down an inequality for the weight of the fridge.

$$95 \leq w < 105 \quad \text{B1}$$

Answer [1]

- 2 Average resale price of 4 room and 5 room HDB flats from 2013 to 2015



Source: PropertyGuru Research, HDB

Mr Pang says that the price of a resale 5 room flat is thrice the price of a resale 4 room flat in 2015.

Is Mr Pang correct? Explain.

Vertical scale does not start from zero.

Price of 5 room flat is $1\frac{2}{9}$ times the price of 4 room flat.

[1]

- 3 (a) Simplify $15m^2n^{-2} \div 3mn^2$.

$$5mn^{-4} \text{ or } \frac{5m}{n^4} \quad \text{B1}$$

Answer [1]

- (b) Given that $5^{-3} \times 5^p = 1$, write down the value of p .

$$p = 3 \quad \text{B1}$$

Answer $p =$ [1]

- 4 (a) Express 7056 as a product of its prime factors.

$$2^4 \times 3^2 \times 7^2 \quad \text{B1}$$

Answer [1]

- (b) Using your answer to part (a), explain why 7056 is a perfect square.

Exponents are multiples of 2. B1

.....[1]

- 5 The population of Singapore increased from 1.96×10^6 in 1967 to 5.8×10^6 in 2019. The number increased by $r\%$ every year. Find the value of r .

$$5.8 \times 10^6 = 1.96 \times 10^6 \left(1 + \frac{r}{100}\right)^{52} \quad \text{M1}$$

$$r = 2.11 \quad \text{A1}$$

Answer $r =$ [2]

- 6 Write as a single fraction $\frac{2}{3x-1} - \frac{1}{2x+1}$.

$$\frac{2(2x+1) - (3x-1)}{(3x-1)(2x+1)} \quad \text{M1}$$

$$\frac{x+3}{(3x-1)(2x+1)} \quad \text{A1}$$

Answer [2]

- 7 A swimming pool has an inlet pipe and a drainage pipe. The inlet pipe can fill up the swimming pool in 3 hours. The drainage pipe can completely drain the water in the pool in 4 hours.
Find the time taken to fill up the swimming pool if the drainage pipe is left open.

In 1 hour, $\left(\frac{1}{3} - \frac{1}{4}\right)$ of pool filled. M1

Time = $\left(\frac{1}{3} - \frac{1}{4}\right)^{-1} = 12$ hours A1

Answer hours [2]

- 8 Mrs Tan makes a fruit punch using orange juice, pineapple juice and Sprite.
The ratio orange juice : Sprite is 3 : 5
The ratio Sprite : pineapple juice is 2 : 3

- (a) Find the ratio orange juice : Sprite : pineapple juice.

6 : 10 : 15 B1

Answer : : [1]

- (b) She uses 1.5 litres of Sprite.
How much fruit punch does she make altogether.

Amount of fruit punch = $\frac{1.5}{10} \times 31 = 4.65$ B1 (Accept $\frac{93}{20}$ or $4\frac{13}{20}$)

Answer litres [1]

- 9 (a) Factorise $4x^2 - y^6$.

$(2x + y^3)(2x - y^3)$ B1

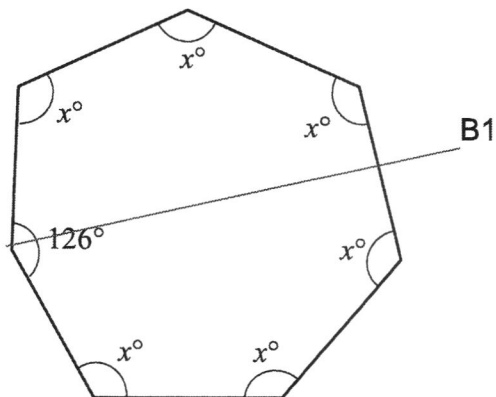
Answer [1]

- (b) Factorise completely $xy + 3y - 5x - 15$.

$y(x+3) - 5(x+3)$ M1 $x(y-5) + 3(y-5)$ M1
 $(x+3)(y-5)$ A1 or $(x+3)(y-5)$ A1

Answer [2]

- 10** An 7-sided polygon has six interior angles measuring x° each.
The remaining interior angle is 126° .



- (a) Draw the line of symmetry on the diagram. [1]
(b) Find the value of x .

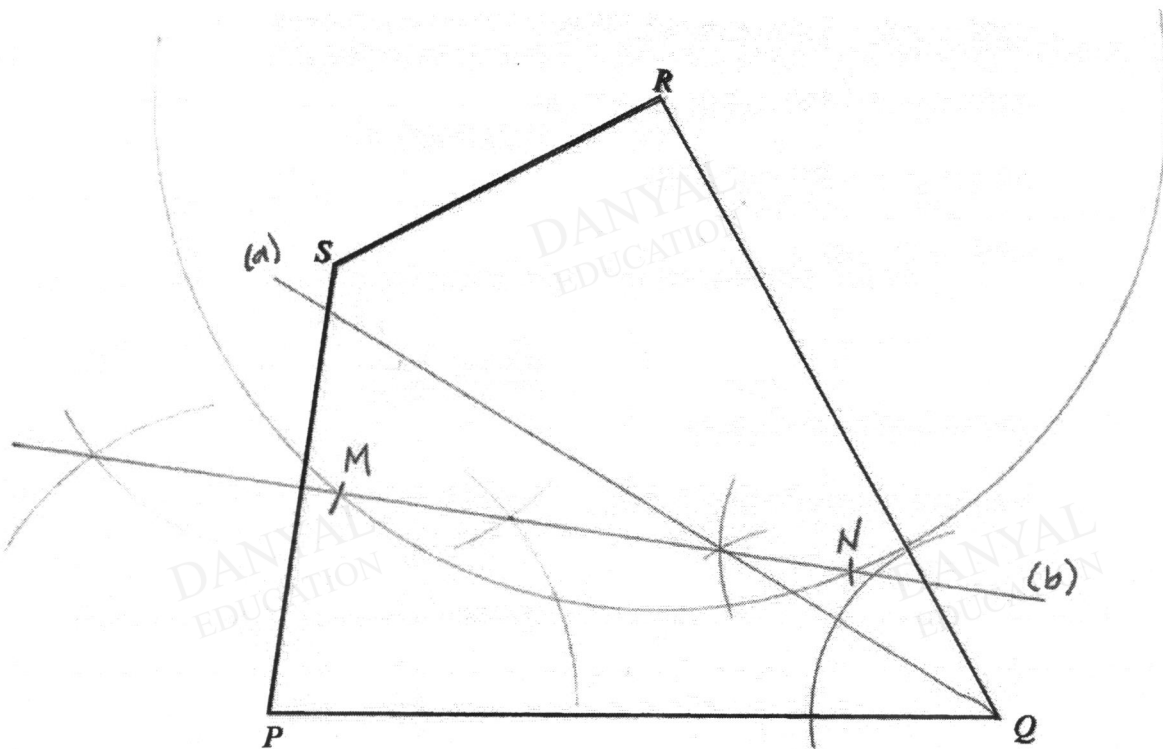
$$6x + 126 = 5 \times 180 \quad \text{M1}$$

$$x = 129 \quad \text{A1}$$

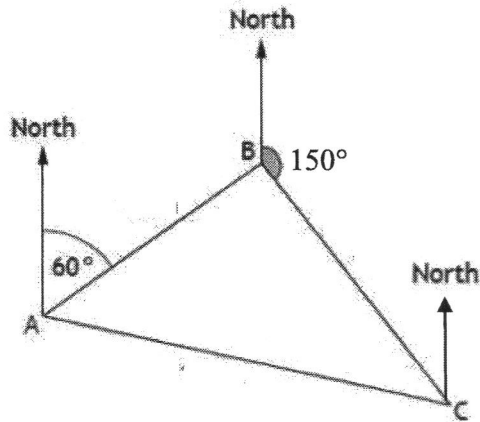
Answer $x = \dots\dots\dots$ [2]

11 The diagram shows a quadrilateral $PQRS$. On the diagram,

- (a) construct the bisector of angle PQR , [1]
- (b) construct the perpendicular bisector of line PS , [1]
- (c) mark and label clearly the points M and N inside the quadrilateral $PQRS$ that is 7 cm from point R and is also equidistant from P and S . [1]



12



A ship travels from A to B on a bearing of 060° and then from B to C on a bearing of 150° . The bearing of A from C is 290° .

- (a) Find the bearing of A from B .

$$\angle ABC = 360^\circ - 150^\circ - (180 - 60)^\circ = 90^\circ$$

$$\begin{aligned} \text{Bearing of } A \text{ from } B &= 150^\circ + \angle ABC \\ &= 240^\circ \end{aligned}$$

B1

- (b) Find angle BAC .

$$\angle ACB = 360^\circ - 290^\circ - (180 - 150)^\circ = 40^\circ$$

$$\angle BAC = 180^\circ - 90^\circ - 40^\circ = 50^\circ$$

$$\angle BAC = 50^\circ$$

M1A1

Answer $^\circ$ [1]

Answer $^\circ$ [2]

- 13 (a) Mr Lee drove for 6 hours at an average speed of x km/h and then for 10 hours at an average speed of y km/h.
He drove a total distance of 1304 km.
Write down an equation in terms of x and y and show that it simplifies to

$$3x + 5y = 652.$$

Answer

$$6x + 10y = 1304 \quad \text{B1}$$

$$\div 2 \quad 3x + 5y = 652$$

[1]

- (b) Mr Pang drove for 4 hours at an average speed of x km/h and then for 6 hours at an average speed of y km/h.
He drove a total distance of 816 km.
Write down an equation, in terms of x and y , to represent this information.

$$4x + 6y = 816 \quad \text{B1}$$

Answer [1]

- (c) Solve the two equations to find the value of x and of y .

$$x = 84, y = 80$$

M1A1

Answer $x = \dots, y = \dots$ [2]

- 14 In the diagram, $OA = OC$, AE and FC are tangents to the circle with centre O . OE and OF are radii of a circle. BF is a straight line passing through point E and O .

- (a) Show that triangle OAE and triangle OCF are congruent.
Give a reason for each statement you make.

Answer

$$OA = OC \text{ (Given)}$$

$$OE = OF \text{ (radius)}$$

$$\angle AOE = \angle COF \text{ (vertically opp } \angle\text{s)}$$

$$\triangle OAE \equiv \triangle OCF \text{ (SAS)} \quad \text{M2A1}$$

$$OA = OC \text{ (Given)}$$

$$OE = OF \text{ (radius)}$$

$$\angle AEO = \angle CFO = 90^\circ \text{ (Radius } \perp \text{ tangent)}$$

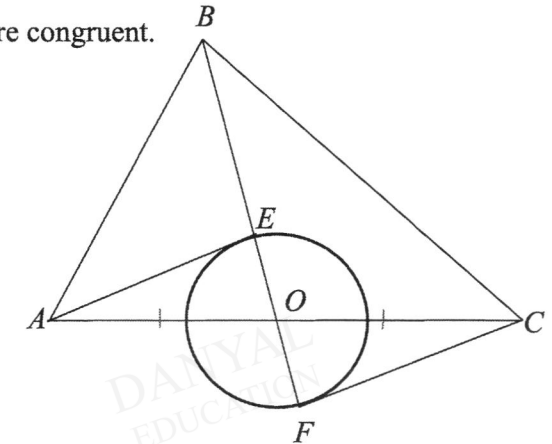
$$\triangle OAE \equiv \triangle OCF \text{ (RHS)} \quad \text{M2A1}$$

$$\angle AOE = \angle COF \text{ (vertically opp } \angle\text{s)}$$

$$\angle AEO = \angle CFO = 90^\circ \text{ (Radius } \perp \text{ tangent)}$$

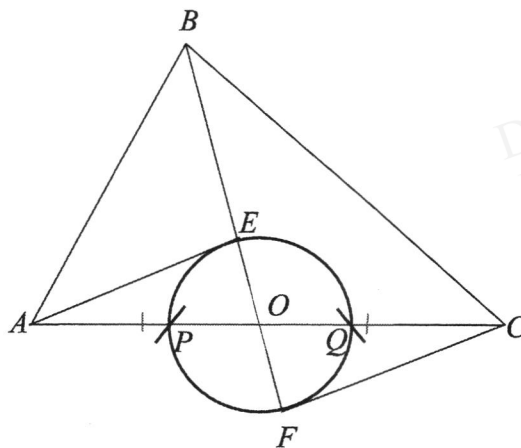
$$OA = OC \text{ (Given) or } OE = OF \text{ (radius)}$$

$$\triangle OAE \equiv \triangle OCF \text{ (AAS)} \quad \text{M2A1}$$

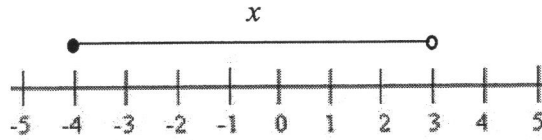


Deduct 1m for no/wrong reason
[3]

- (b) Points P and Q lie on the circumference of the circle such that triangle APE is congruent to triangle CQF . On the diagram, mark the positions for the points, P and Q . [1]



- 15 (a) A range of values for x is represented on the number line below.



Write down inequalities that represent this range of values of x .

$-4 \leq x < 3$ B1

Answer [1]

- (b) (i) Solve the inequality $\frac{5-x}{3} > x+1$.

$5-x > 3x+3$

$4x < 2$ M1

$x < \frac{1}{2}$ A1

Answer [2]

- (ii) Hence state the largest integer of x .

$x = 0$ A1

Answer $x =$ [1]

- 16 $\mathcal{E} = \{\text{integers } x : 4 < x \leq 11\}$ $\mathcal{E} = \{5, 6, 7, 8, 9, 10, 11\}$
 $A = \{\text{multiples of } 5\}$ $A = \{5, 10\}$
 $B = \{\text{prime numbers}\}$ $B = \{5, 7, 11\}$ $B' = \{6, 8, 9, 10\}$

- (a) List the elements contained in the set $(A \cup B)'$.

$\{6, 8, 9\}$ B1

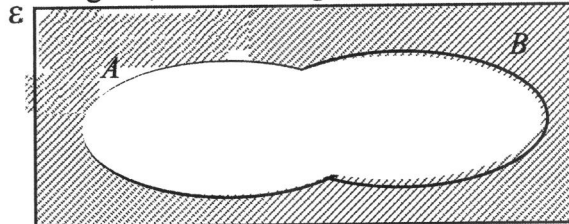
Answer [1]

- (b) List the elements contained in the set $A \cap B'$.

$\{10\}$ B1

Answer [1]

- (c) On the Venn diagram, shade the region which represents $A' \cap B'$.



[1]

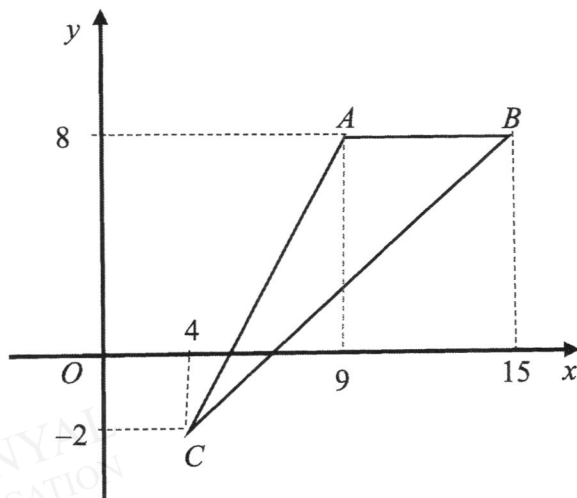
- (d) $C = \{\text{negative integers}\}$
 Complete the statement using set notations.

$A \cap C =$

[1]

\emptyset or $\{ \}$ B1

- 17 The points A , B and C are $(9, 8)$, $(15, 8)$ and $(4, -2)$ respectively.



Find

- (a) the gradient of AC ,

$$\text{gradient of } AC = 2$$

B1

Answer [1]

- (b) the equation of the line which passes through $(0, 5)$ and is parallel to AC ,

$$y = 2x + 5$$

B1

Answer [1]

- (c) the length of AC ,

$$\text{length} = \sqrt{10^2 + 5^2} = 11.2$$

B1

Answerunits [1]

- (d) the value of $\cos \angle BAC$.

$$-\frac{5}{\sqrt{125}} = -0.447$$

B1

Answer $\cos \angle BAC = \dots\dots\dots$ [1]

- 18 A factory supplies coffee beans to shop *A*, *B* and *C*.
The matrix, **P**, shows the number of bags of 5 kg, 10 kg and 15 kg sold to to shop *A*, *B* and *C*.

$$P = \begin{matrix} & \begin{matrix} 5\text{kg} & 10\text{kg} & 15\text{kg} \end{matrix} \\ \begin{pmatrix} 20 & 50 & 30 \\ 40 & 60 & 20 \\ 30 & 20 & 50 \end{pmatrix} & \begin{matrix} \text{Shop } A \\ \text{Shop } B \\ \text{Shop } C \end{matrix} \end{matrix}$$

The factory delivers the coffee beans to shop *A*, *B* and *C* three times yearly.

- (a) Evaluate the matrix **S** = 3**P**.

$$\text{Answer } S = \begin{pmatrix} 60 & 150 & 90 \\ 120 & 180 & 60 \\ 90 & 60 & 150 \end{pmatrix} \quad [1]$$

- (b) The cost of 5 kg, 10 kg and 15 kg bags are \$9.50, \$12.60 and \$23 respectively.
Represent the prices of the coffee beans in a 3 × 1 column matrix **Q**.

$$\text{Answer } Q = \begin{pmatrix} 9.5 \\ 12.6 \\ 23 \end{pmatrix} \quad [1]$$

- (c) Evaluate the matrix **T** = **SQ**.

$$T = \begin{pmatrix} 60 & 150 & 90 \\ 120 & 180 & 60 \\ 90 & 60 & 150 \end{pmatrix} \begin{pmatrix} 9.5 \\ 12.6 \\ 23 \end{pmatrix}$$

$$T = \begin{pmatrix} 60(9.5) + 150(12.6) + 90(23) \\ 120(9.5) + 180(12.6) + 60(23) \\ 90(9.5) + 60(12.6) + 150(23) \end{pmatrix}$$

$$T = \begin{pmatrix} 4530 \\ 4788 \\ 5061 \end{pmatrix}$$

B2[Deduct B1 for each error]

$$\text{Answer } T = \begin{pmatrix} 4530 \\ 4788 \\ 5061 \end{pmatrix} \quad [2]$$

- (d) State what each of the elements of **T** represents.

Total sales of coffee beans to Shop A(\$4530), Shop B(\$4788) and Shop C (\$5061) in a year.

.....[1]

- 19 The diagram shows the floor plan of Mr Koh's rectangular kitchen. It is drawn to a scale of 1 cm represents n metres.

The actual area of the floor is 124 m^2 .

- (a) Use the plan to find the value of n , correct to the nearest integer.

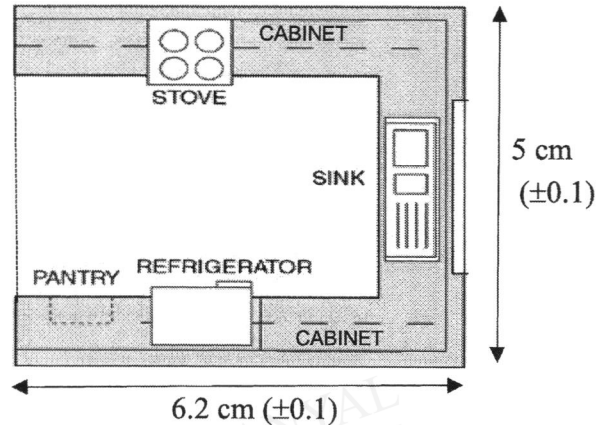
$$5 \times 6.2 \text{ cm}^2 : 124 \text{ m}^2 \quad \text{M1}$$

$$31 \text{ cm}^2 : 124 \text{ m}^2$$

$$1 \text{ cm}^2 : \frac{124}{31} \text{ m}^2 \quad \sqrt{\text{A1}}$$

$$1 \text{ cm}^2 : 4 \text{ m}^2$$

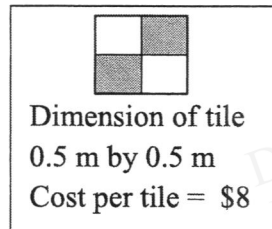
$$1 \text{ cm} : 2 \text{ m}$$



Answer $n = \dots\dots\dots$ [2]

- (b) Mr Koh decides to lay tiles on the kitchen floor before the installation of the cabinets, stove, sink and refrigerator.

The dimensions and cost of one square tile are shown below.



Using your answer in part (a), find

- (i) the number of tiles needed,

$$\text{Length} = 6.1 \times 2 = 12.2 \text{ m}$$

$$\text{Length} = 6.2 \times 2 = 12.4 \text{ m}$$

$$\text{Length} = 6.3 \times 2 = 12.6 \text{ m}$$

$$\text{Width} = 4.9 \times 2 = 9.8 \text{ m}$$

$$\text{Width} = 5 \times 2 = 10 \text{ m}$$

$$\text{Width} = 5.1 \times 2 = 10.2 \text{ m}$$

$$\text{No of tiles} = 25$$

$$\text{No of tiles} = 25$$

$$\text{No of tiles} = 26$$

$$\text{No of tiles} = 20$$

$$\text{No of tiles} = 20$$

$$\text{No of tiles} = 21$$

$\sqrt{\text{A1}}$

$$\text{No of tiles} = 20 \times 25 = 500, 20 \times 26 = 520, 21 \times 25 = 525, 21 \times 26 = 546$$

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

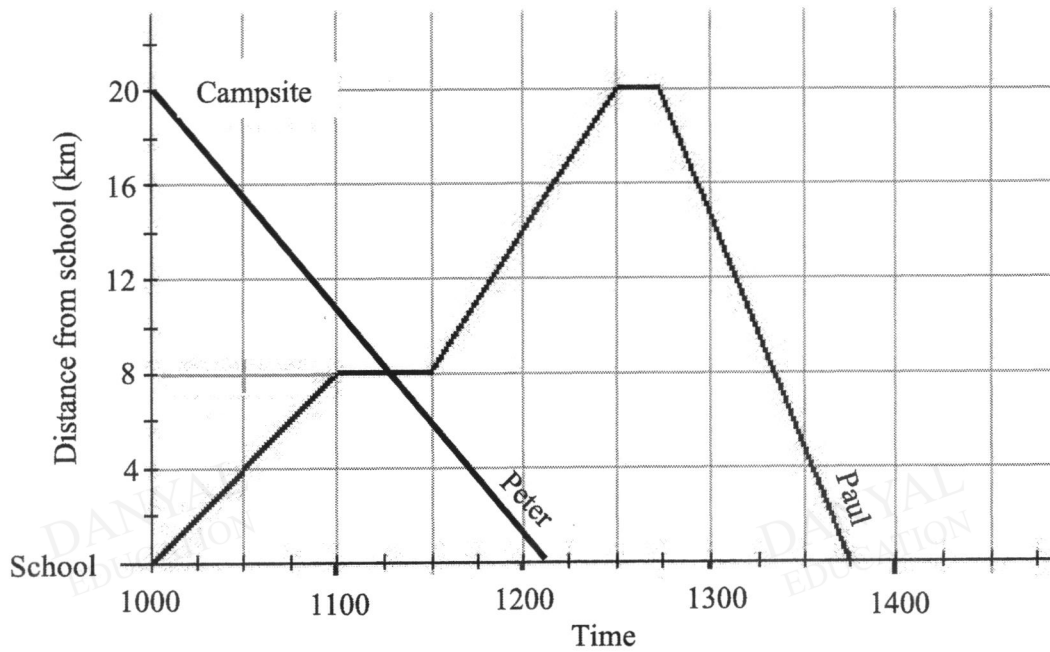
- (ii) the cost of buying the tiles .

$$\text{Cost} = 500 \times \$8 = \$4000, 520 \times \$8 = \$4160, 525 \times \$8 = \$4200, 546 \times \$8 = \$4368$$

$\sqrt{\text{A1}}$

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

20



The distance-time graph shows the journeys for Peter and Paul between school and campsite.

- (a) Find Paul's speed at 12 pm.

$$\text{Speed} = \frac{(20-8)\text{km}}{1\text{h}} = 12\text{km/h} \quad \text{M1A1} \quad \text{Answer} \dots\dots 12\dots\dots \text{km/h} \quad [2]$$

- (b) (i) Find the time when Peter and Paul meet each other.

Answer1115..... [B1]

- (ii) How far are they from the Campsite when they meet each other.

Answer10..... km [B1]

- (c) How long did Paul stay at the Campsite?

Answer15..... minutes [B1]

- (d) Find Paul's speed at 10.30 am in metres per second.

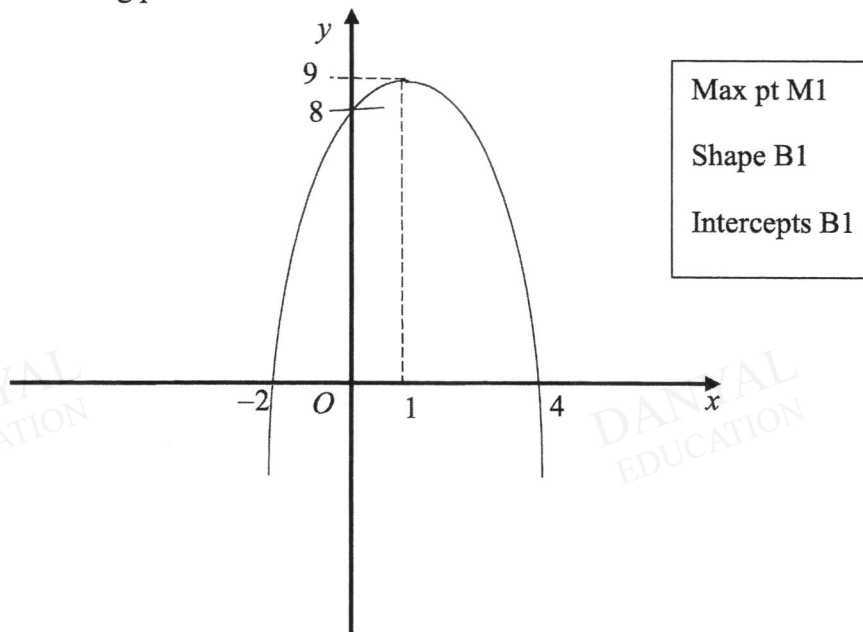
$$\text{Speed} = \frac{8\text{km}}{1\text{h}} = \frac{8000\text{m}}{3600\text{s}} = \frac{20}{9}\text{m/s} \quad \text{B1}$$

Accept $2\frac{2}{9}$, 2.22

Answer m/s [1]

- 21 (a) **Sketch** the graph of $y = -(x+2)(x-4)$ on the axes below.

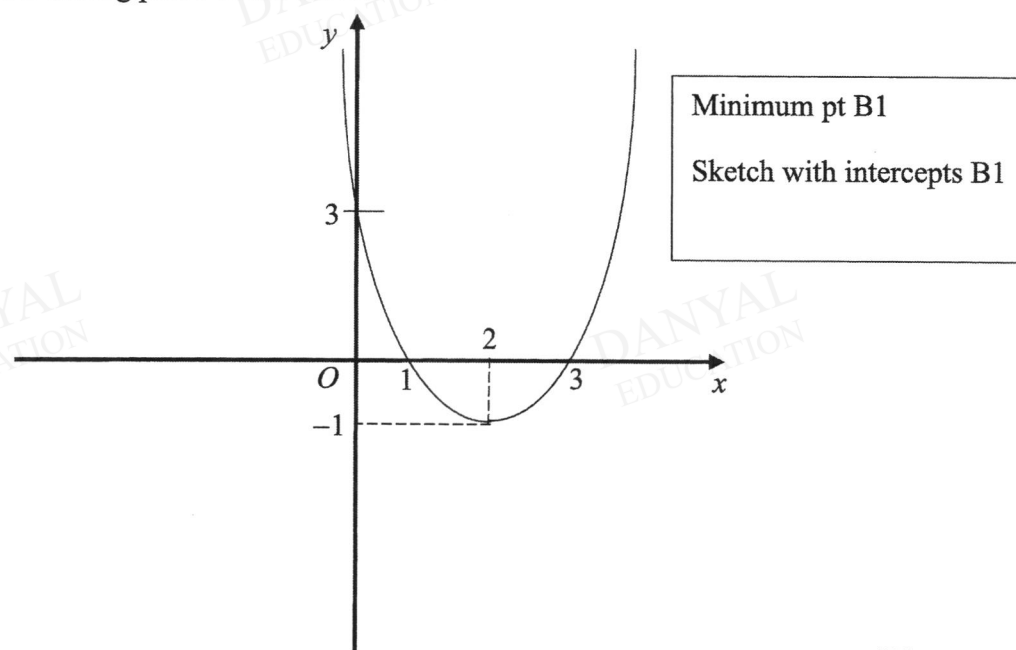
Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve.



[3]

- (b) **Sketch** the graph of $y = (x-2)^2 - 1$ on the axes below.

Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve.



[2]

- (c) Write down the equation of the line of symmetry of $y = (x-2)^2 - 1$

$x = 2$ B1

Answer [1]

22 A bag contains 8 buttons, n of which are white and the rest are black.

A button is chosen at random and not replaced.

(a) Write down, in terms of n , the probability that the button is black.

$$\frac{8-n}{8} \quad \text{B1}$$

Answer [1]

A second button is chosen at random.

(b) Find, in terms of n , the probability that both buttons are black.

$$\frac{8-n}{8} \times \frac{7-n}{7} \quad \text{B1}$$

Answer [1]

(c) (i) The probability that both buttons are black is $\frac{3}{28}$.

Show that $n^2 - 15n + 50 = 0$.

Answer

$$\frac{8-n}{8} \times \frac{7-n}{7} = \frac{3}{28}$$

$$(8-n)(7-n) = 6$$

$$n^2 - 15n + 56 = 6$$

$$n^2 - 15n + 50 = 0$$

[M1 for removing denominator M1 for expand and simplify]

[2]

(ii) Solve the equation $n^2 - 15n + 50 = 0$ to find the number of black buttons in the bag.

$$(n-10)(n-5) = 0$$

M1 for factorisation or using quad formula

$$n = 10 \text{ (rejected) or } n = 5$$

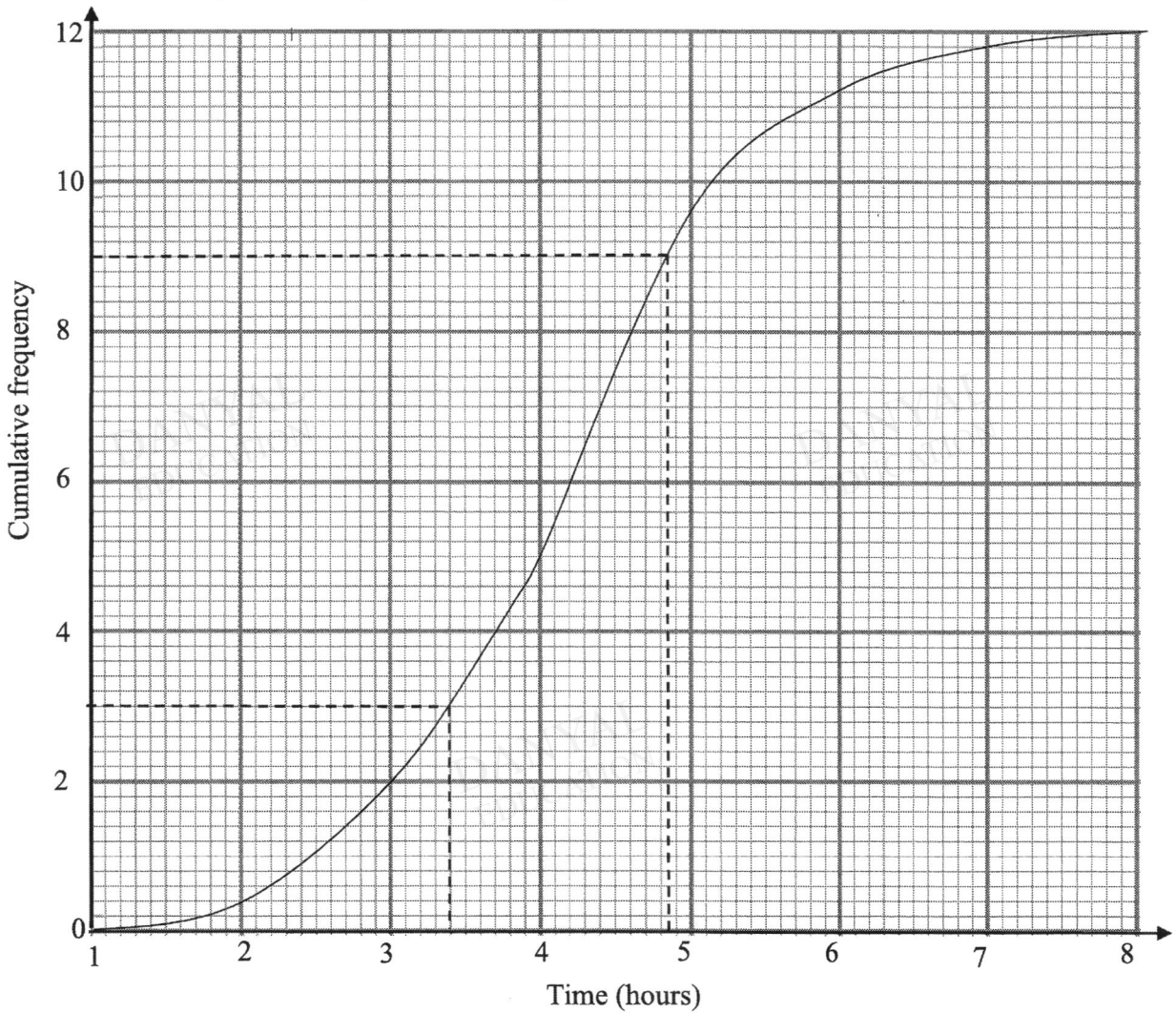
B1

$$\text{No of black buttons} = 3$$

A1

Answer buttons [3]

- 23 The cumulative frequency curve shows the time spent by 12 students from school *A* on mobile phones on a particular Sunday



- (a) Use the graph to find

- (i) the median time spent on handphone,

$$\text{Median} = 4.2 \quad \text{B1}$$

Answer h [1]

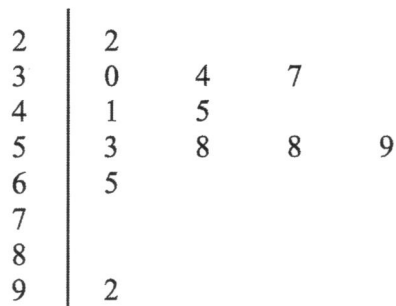
- (ii) the interquartile range.

$$\text{IQR} = 4.85 - 3.4 \quad \text{M1}$$

$$= 1.45 \quad \text{A1}$$

Answer h [2]

The stem–and–leaf diagram shows the time spent by 12 students from school *B* on mobile phones on a particular Sunday



Key: 2 | 2 represents 2.2 hours

- (b) Find the median time spent on mobile phone,

$$\begin{aligned} \text{Median} &= \frac{4.5 + 5.3}{2} \\ &= 4.9 \quad \text{B1} \end{aligned}$$

Answer h [1]

- (c) Explain why the mean may not be an appropriate average to use to summarise the time spent by these students on mobile phone.

Answer

The mean may not be useful in summarising the time spent as there is an extreme value of 9.2 hours which may affect the mean of the data.

[1]

- (d) Make one comparison on the time spent by students on mobile phones.

Answer

Students from school *B* spent more than on their mobile phones as their median time (4.9h) is greater than the median time (4.2h) of school *A*.

[1]

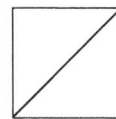


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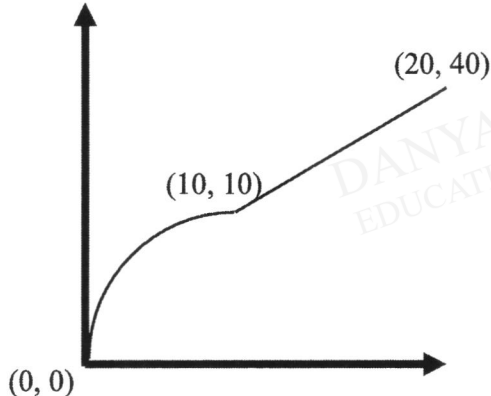
Date:



Qn	Solution	Marks
1a	$s = 67.5$	B1
1b	$s = ut + \frac{1}{2}at^2$ $\frac{1}{2}at^2 = s - ut$ $a = \frac{s - ut}{\frac{1}{2}t^2}$ $= \frac{2(s - ut)}{t^2}$	M1 A1
2a	$\left(x - \frac{9}{2}\right)^2 - \frac{13}{4}$	B1
2b	$\left(x - \frac{9}{2}\right)^2 - \frac{13}{4} = 0$ $\left(x - \frac{9}{2}\right)^2 = \frac{13}{4}$ $x - \frac{9}{2} = \pm\sqrt{\frac{13}{4}}$ $x = \frac{9}{2} \pm \sqrt{\frac{13}{4}}$ $= 6.3027 \text{ or } 2.6972$ $= 6.30 \text{ or } 2.70$	M1 A1
3	$F = \frac{k}{d^2}$ <p>Since d is decreased by 75%, d is now $0.25d$</p> $\text{So } F_{\text{new}} = \frac{k}{(0.25d)^2}$ $= 16 \frac{k}{d^2}$ $= 16F$ $\% \text{ change} = \frac{16F - F}{F} \times 100\%$ $= 1500\%$	M1 M1 M1 A1
4i	\$2298.96	B1

4ii	$2298.96 - P = P \times \frac{3}{100} \times \frac{18}{12}$ $2298.96 = 0.045P + P$ $2298.96 = 1.045P$ $P = \frac{2298.96}{1.045}$ $= \$2199.96$	M1 A1
4iii	$\frac{2199.96}{80} \times 100 = \2749.95	B1
5i	<i>mean = 181</i>	B1
5ii	<i>s.d. = 40.3</i>	B1
5iii	I disagree with the Principal's comparison as he compared two different values. For 2019 he used the mean but for 2020, he used the median.	B1
6a	$32k^2 - 18 = 2(16k^2 - 9)$ $= 2(4k + 3)(4k - 3)$	M1 A1
6b	$\frac{32k^2 - 18}{4k^2 + 7k + 3} = \frac{2(4k + 3)(4k - 2)}{(4k + 3)(k + 1)}$ $= \frac{2(4k - 2)}{(k + 1)}$	M1 A1
7	$\frac{x-7}{2x-5} + \frac{2}{5-2x} = -\frac{1}{4}$ $\frac{x-7}{2x-5} - \frac{2}{2x-5} = -\frac{1}{4}$ $\frac{x-7-2}{2x-5} = -\frac{1}{4}$ $\frac{x-9}{2x-5} = -\frac{1}{4}$ $4x - 36 = -2x + 5$ $6x = 41$ $x = \frac{41}{6}$	M1 M1 M1 A1
8	$\frac{V_A}{V_B} = \frac{8}{1} \Rightarrow \frac{h_A}{h_B} = \sqrt[3]{\frac{8}{1}} = \frac{2}{1}$ $\therefore h_A = 2 \times 10 = 20 \text{ cm}$ $\frac{SA_B}{SA_C} = \frac{9}{4} \Rightarrow \frac{h_B}{h_C} = \sqrt{\frac{9}{4}} = \frac{3}{2}$ $\therefore h_B = \frac{3}{2} \times 10 = 15 \text{ cm}$ <p>Difference = 20 - 15 = 5 cm</p>	M1 M1 M1 A1
9a	$T_5 = 5^2 \times 63 = 1575$	B1

9b	$T_n = n^2 \times [91 + (n-1)(-7)]$ $= n^2 \times (-7n + 98)$ $= -7n^3 + 98n^2$	M1 A1												
9c	$-7n^3 + 98n^2 = 0$ $7n^3 = 98n^2$ $7n = 98$ $n = 14$ <p>Yes. The sequence is a 0 when the term is 14.</p>	M1 A1												
10a	$53^2 = 2809$ $45^2 + 28^2 = 2809$ <p>By Converse of PT, since $53^2 = 45^2 + 28^2$,</p> $\angle ADC = 90^\circ$	M1 A1												
10b	$72^2 = 53^2 + 116^2 - 2(53)(116) \cos \angle BAC$ $\cos \angle BAC = \left(\frac{116^2 + 53^2 - 72^2}{2(116)(53)} \right)$ $\angle BAC = \cos^{-1} \left(\frac{116^2 + 53^2 - 72^2}{2(116)(53)} \right)$ $= 25.685$ $= 25.7^\circ$	M1 M1 A1												
10ci	$\tan 11.77 = \frac{CT}{72}$ $CT = 72 \tan 11.77$ $= 15.002$ $= 15.0 \text{ m}$	M1 A1												
10cii	$\frac{1}{2} (53)(116) \sin 25.685$ $= 1332.36$ $= 1330 \text{ m}^2$	M1 A1												
10d	$\text{shortest distance} = \frac{1332.36}{\frac{1}{2} \times 116}$ $= 22.9717$ $\angle \text{ of elevation} = \tan^{-1} \left(\frac{15.002}{22.9717} \right)$ $= 33.14$ $= 33.1^\circ$	M1 M1 A1												
11i	<table border="1" style="display: inline-table; vertical-align: middle;"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <th>1</th> <td>X</td> <td>(2,1)</td> <td>(3,1)</td> <td>(4,1)</td> <td>(5,1)</td> </tr> </tbody> </table>		1	2	3	4	5	1	X	(2,1)	(3,1)	(4,1)	(5,1)	B1
	1	2	3	4	5									
1	X	(2,1)	(3,1)	(4,1)	(5,1)									

	2	(1,2)	X	(3,2)	(4,2)	(5,2)		
	3	(1,3)	(2,3)	X	(4,3)	(5,3)		
	4	(1,4)	(2,4)	(3,4)	X	(5,4)		
	5	(1,5)	(2,5)	(3,5)	(4,5)	X		
11ia	$\frac{1}{10}$							B1
11ib	$\frac{3}{10}$							B1
11ic	0							B1
11id	$\frac{2}{5}$							B1
12a	$\frac{20\text{m}}{1\text{s}} = \frac{2 \div 1000 \text{ km}}{1 \div 60 \div 60 \text{ h}}$ $= 72\text{km/h}$							M1 A1
12b								B1 for (10,10) B1 for curve B1 for straight line ending at (20,40)
13a	$\angle DAB + \angle ABC = 180$ (int \angle)							B1
13b	$\cos \theta = \frac{1}{5}$ $\theta = 1.369 \text{ rad}$							M1 A1
13c	$\text{arc } AE = 3(1.369) = 4.107$ $\text{arc } BE = 2(\pi - 1.369) = 3.5451$ $\text{length } AB = \sqrt{5^2 - 1^2} = 4.89897$ $\text{perimeter} = 12.551 = 12.6 \text{ cm}$							M1 M1 M1 A1
14ai	23 (angles in same segment)							B1
14aii	$90 - 23 = 67$ (angle in semicircle)							B1
14aiii	$180 - 67 = 113$ (angle in opposite segment, cyclic quad)							B1

14b	<p>If D is the center, then</p> $\angle DCE = 90^\circ = \angle DBE \text{ (tangent } \perp \text{ radius)}$ $\angle CBE = 65 \times 2 \text{ (}\angle \text{ centre} = 2 \angle \text{ at circumference)}$ $= 130^\circ$ <p>\angle sum of quadrilateral $DCEB = 90 + 90 + 130 + 48$</p> $= 358 \neq 360$ <p>Since the angle sum is not 360°, there is an error in our assumption.</p> <p>D is not the center of the circle.</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>A1</p>
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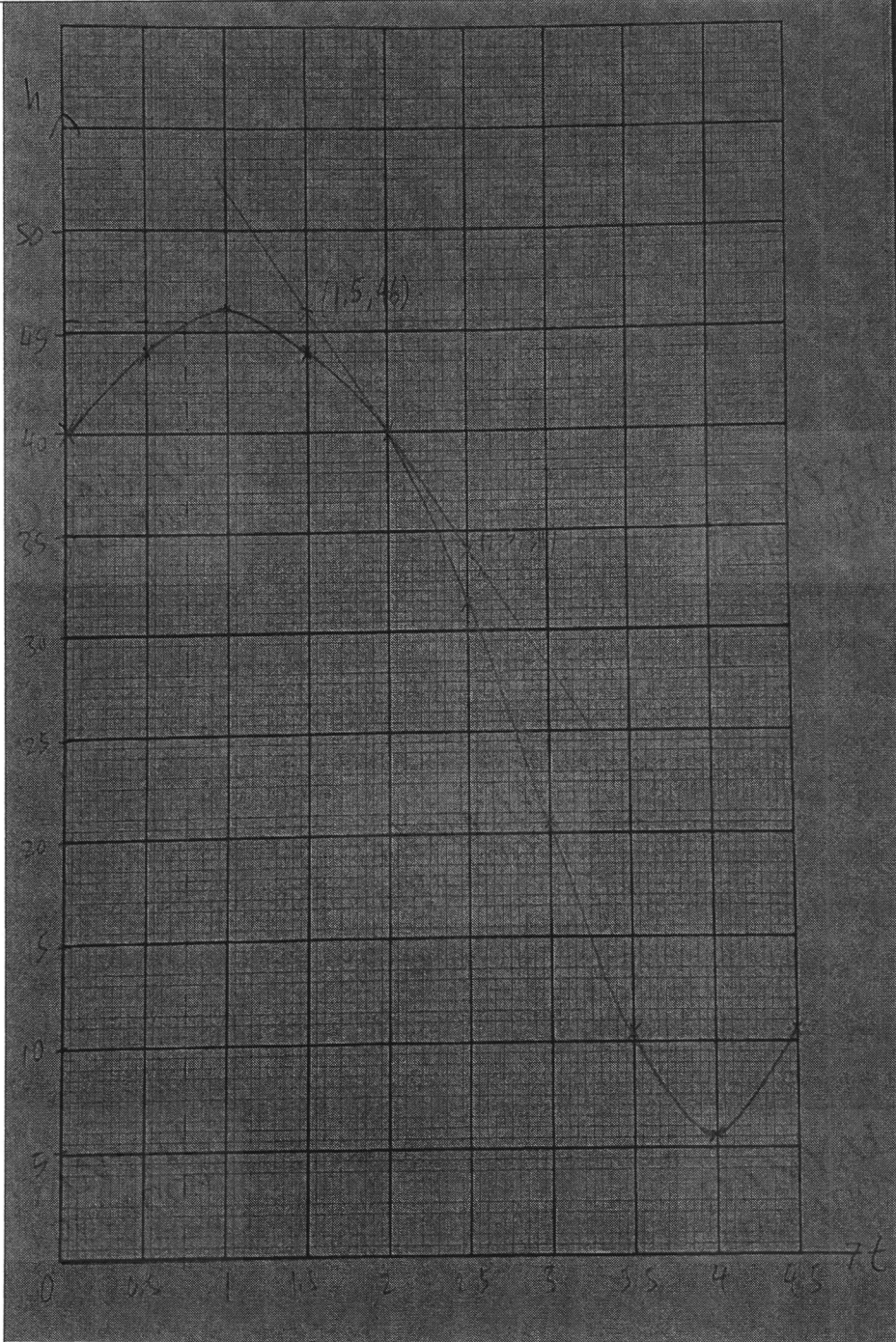
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15a



15b	Yes, the minimum point is more than 5m.	B1
15c	45.5m (± 0.25)	B1
15di	Balanced gradient drawn $-12(\pm 1.0)$	B1 B1
15dii	The rate of descend at $t = 2$. The speed of rollercoaster descending at $t = 2$.	B1
15e	$t = 3.5(\pm 0.5)$	B1
16ai	$360 \div 5 = 72^\circ$	B1

16aii	$\angle OBA = 54^\circ$ (base of isos triangle) By Sine Rule, $\frac{OA}{\sin 54^\circ} = \frac{4}{\sin 72^\circ}$ $OA = 3.4026 \text{ cm}$ (shown)	M1 M1 A1
16aiii	$\text{Area of triangle OAB} = \frac{1}{2}(3.4026)^2 \sin 72^\circ$ $= 5.5055$ $\text{Area of ABCDE} = 5.5055 \times 5$ $= 27.5 \text{ cm}^2$	M1 A1
16b	Volume = $27.52 \times 10 = 275 \text{ cm}^3$ (3s.f.)	B1
16c	$\text{Total surface area} = 2 \times 27.527 + 5 \times 4 \times 10$ $= 255.054$ $\text{Total surface area of 100 prism} = 25505.4$ <p>Assuming paint is 1 cm^3 thick, Cans needed = $25505.4 \div 5000$</p> $= 6 \text{ cans (rounded up)}$ $\text{Total cost} = 6 \times 24.99$ $= 149.94 > 130$ <p>Mr Chin's budget is insufficient.</p>	M1 M1 M1 A1
17a	Option A, as taking Option B will cause him to reach after 6pm.	B1
17b	min. average speed = $\frac{8.8}{14 \div 60} = 37.7 \text{ km/h}$	M1 A1
17ci	$k = 0.1008 = 0.10$	B1
17cii	<u>Bali Rani Hotel</u> Accommodation = \$262 $\text{Waterbom admissions} = 3(455\,000) + 327\,000 = 1\,692\,000 \text{ IDR}$ $\text{In SGD, Waterbom} = \170.55 $\text{Total} = \$432.55 > \430 <u>Bintang Bali</u> Accommodation = \$296 $\text{Waterbom admissions} = 0.75 \times 170.55 = \127.91 $\text{Total} = \$423.91 < \430 <u>Conclusion</u> No, only Bintang Bali will allow Mr Tan to keep the total cost under SGD \$430.	M1 M1 M1 M1 M1 A1