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

CANDIDATE NAME	
CLASS	REGISTER NUMBER

MATHEMATICS **4048/01**
Paper 1 **28 August 2020**
2 hours

MARK SCHEME

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.

For Examiner's Use

	ANnotations	**AC**curacy
Marks Deducted	**3**	**1**

This document consists of 21 printed pages and 3 blank pages.
Setter: Mrs Ho Thuk Lan

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 = $4\pi r^2$

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

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

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

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

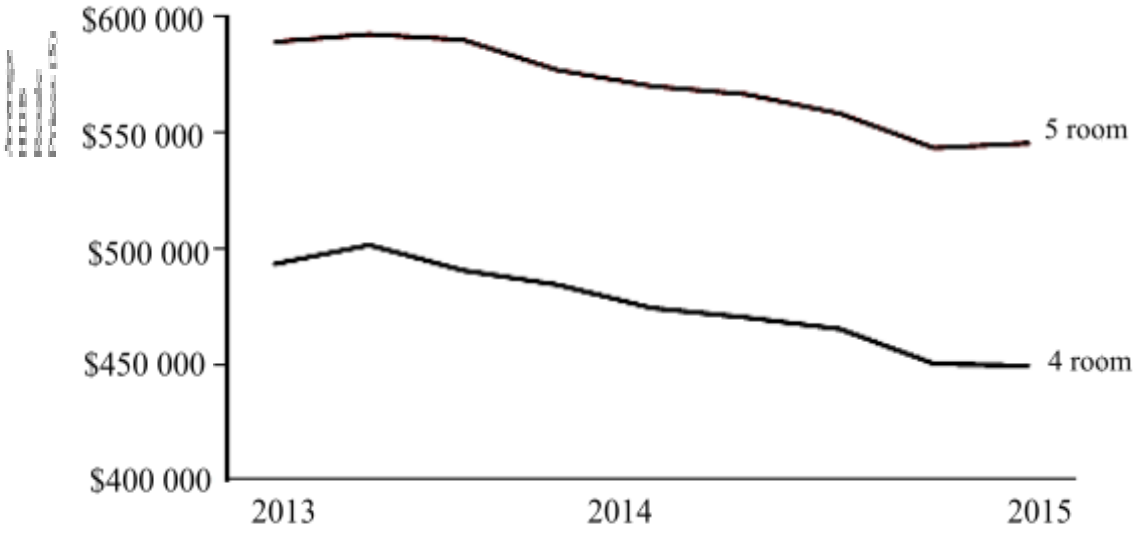
1 The weight, w, of a fridge is 100 kg correct to the nearest ten.
Write down an inequality for the weight of the fridge.

$95 \leq w < 105$ 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 3 times the price of 4 room flat.

……

……[1]

---

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

$5mn^{-4}$ or $\dfrac{5m}{n^4}$ B1

Answer ..... [1]

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

$p = 3$ B1

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

---

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

$2^4 \times 3^2 \times 7^2$ 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.

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

$r = 2.11$ A1

Answer $r =$ ..... [2]

---

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

$\dfrac{2(2x+1)-(3x-1)}{(3x-1)(2x+1)}$ M1

$\dfrac{x+3}{(3x-1)(2x+1)}$ 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 $4x^2-y^6$.

$\left(2x+y^3\right)\left(2x-y^3\right)$ B1

Answer …… [1]

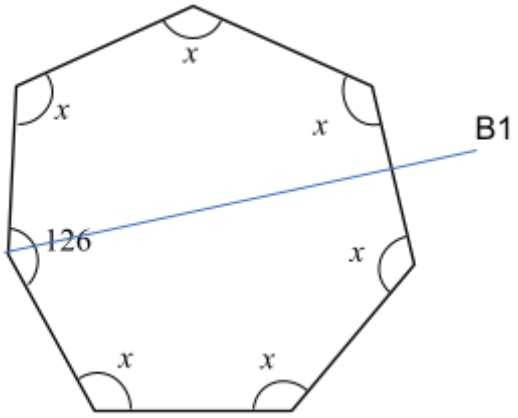
(b) Factorise completely $xy+3y-5x-15$.

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

$6x + 126 = 5 \times 180$ M1
$x = 129$ A1

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

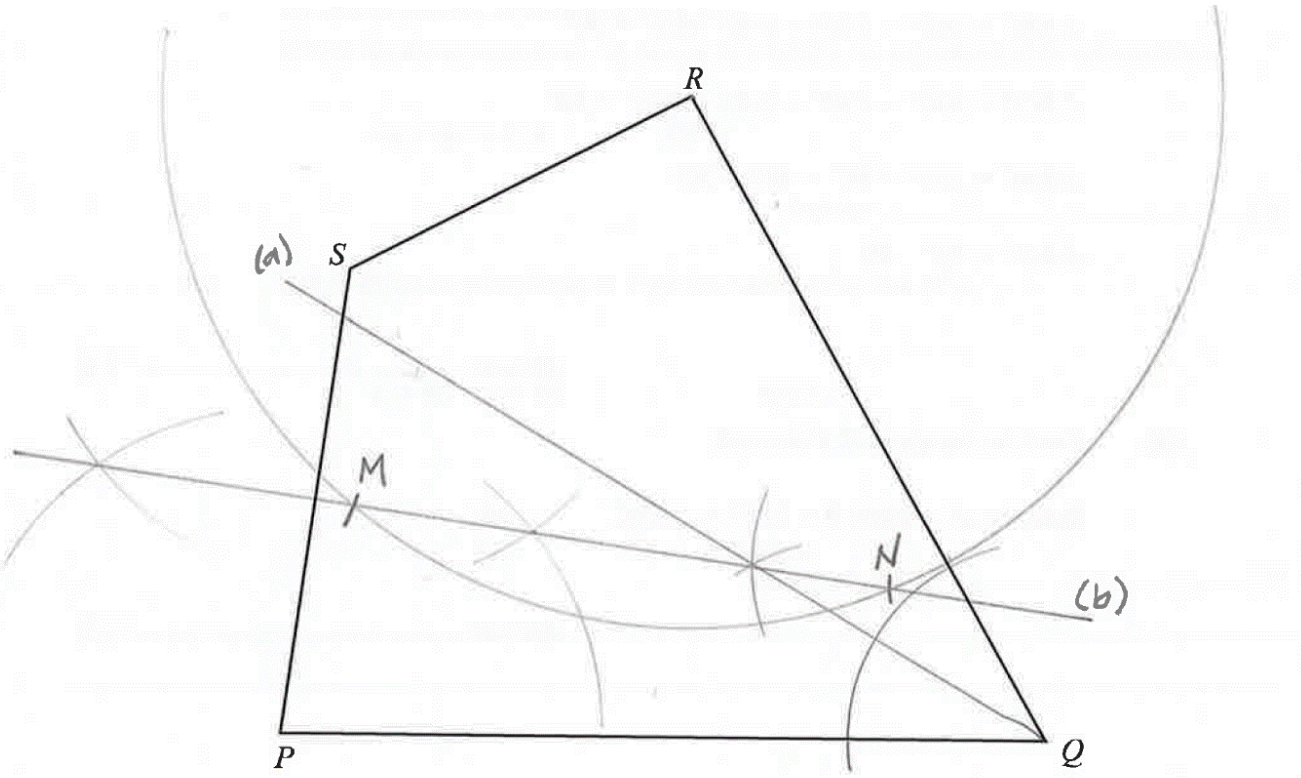
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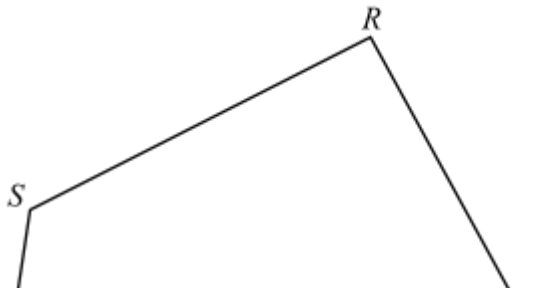
11 The diagram shows a quadrilateral *PQRS.* On the diagram,

(a) construct the bisector of angle *PQR,* [1]

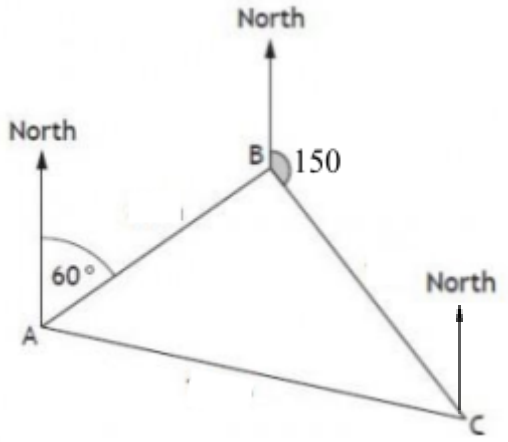
(b) construct the perpendicular bisector of line *PS,* [1]

(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.

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

Bearing of A from $B = 150° + \angle ABC$
$= 240°$ B1

(b) Find angle *BAC*.

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

$\angle BAC = 180° - 90° - 40° = 50°$

$\angle BAC = 50°$ M1A1

Answer ..... ° [1]

Answer ..... ° [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

$6x + 10y = 1304$ B1

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

[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.

$4x + 6y = 816$ B1

Answer …… [1]

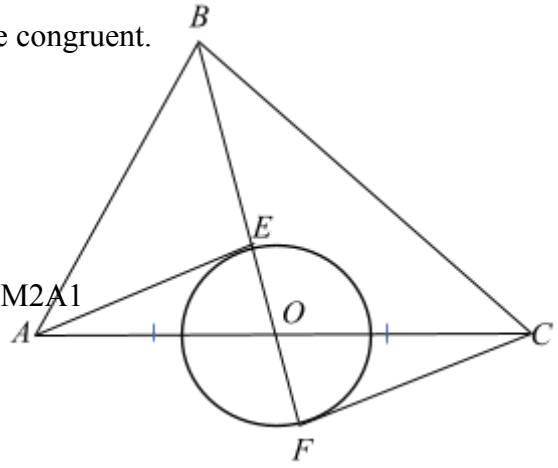
(c) Solve the two equations to find the value of x and of y.

$x = 84$, $y = 80$ M1A1

Answer x = …… , y = …… [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

$OA = OC$ (Given)
$OE = OF$ (radius)
$\angle AOE = \angle COF$ (vertically opp $\angle$s)
$\Delta OAE \equiv \Delta OCF$ (SAS) M2A1

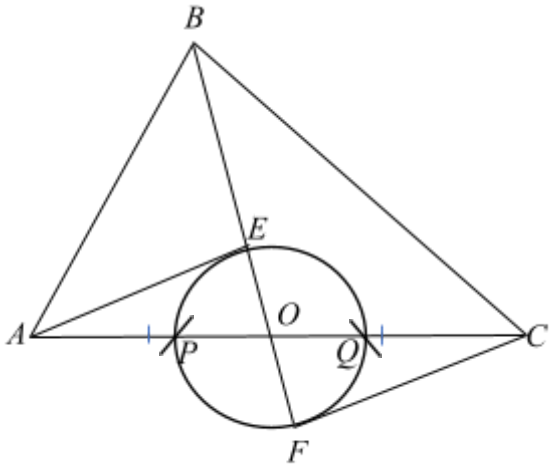
$OA = OC$ (Given)
$OE = OF$ (radius)
$\angle AEO = \angle CFO = 90°$ (Radius $\perp$ tangent)
$\Delta OAE \equiv \Delta OCF$ (RHS) M2A1

$\angle AOE = \angle COF$ (vertically opp $\angle$s)
$\angle AEO = \angle CFO = 90°$ (Radius $\perp$ tangent)

$OA = OC$ (Given) or $OE = OF$ (radius)
$\Delta OAE \equiv \Delta OCF$ (AAS) M2A1

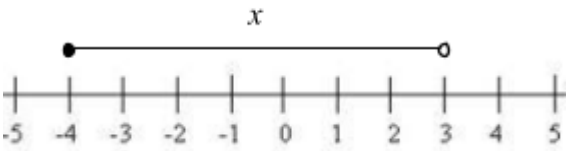
Deduct 1m for no/wrong reason
[3]

(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.

$-4 \le x < 3$ B1

Answer ..... [1]

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

$5 - x > 3x + 3$

$4x < 2$

$x < \frac{1}{2}$ A1 M1

Answer ..... [2]

(ii) Hence state the largest integer of x.

$x = 0$ A1

Answer $x =$ ……..…… [1]

---

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

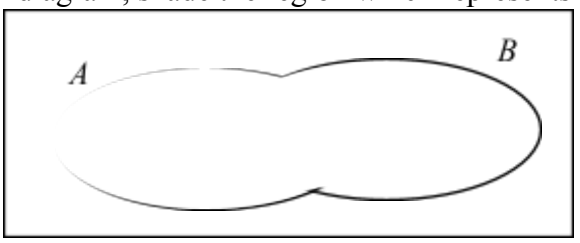
Answer …… [1]

(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 $A' \cap B'$.



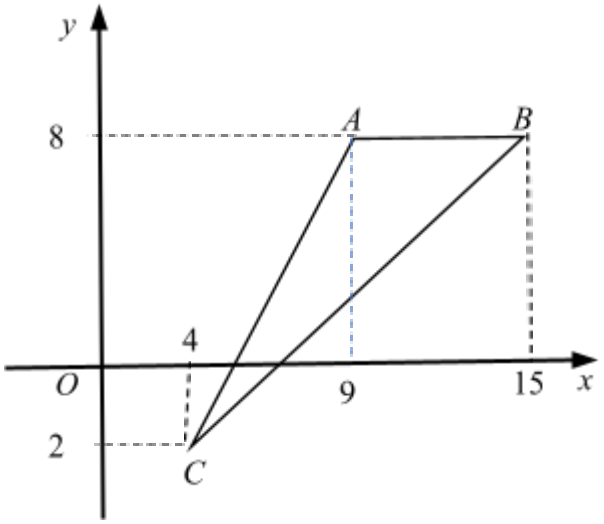
[1]

(d) C = {negative integers}
Complete the statement using set notations.
$A \cap C =$ …… [1]

$\varnothing$ or { } B1

---

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



Find

(a) the gradient of AC,

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,*

length = $\sqrt{10^2 + 5^2} = 11.2$ B1

Answer .....units [1]

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

$-\frac{5}{\sqrt{125}} = -0.447$ B1

Answer cos $\angle BAC$ =..... [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*.

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

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

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

Answer **S** = $\begin{pmatrix} 60 & 150 & 90 \\ 120 & 180 & 60 \\ 90 & 60 & 150 \end{pmatrix}$ [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 $\mathbf{Q} = \begin{pmatrix} 9.5 \\ 12.6 \\ 23 \end{pmatrix}$ [1]

(c) Evaluate the matrix $\mathbf{T} = \mathbf{SQ}$.

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

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

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

B2[Deduct B1 for each error]

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

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

[redacted]……..

[redacted]……..

……...……..[1]

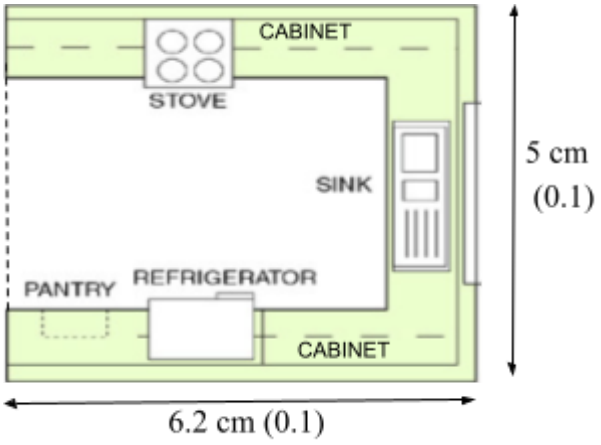
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19 The diagram shows the floor plan of Mr Koh's rectangular kitchen.
It is drawn to a scale of 1cm represents *n* metres.

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.

$5 \times 6.2\ cm^2 : 124\ m^2$ M1



$31\ cm^2 : 124\ m^2$

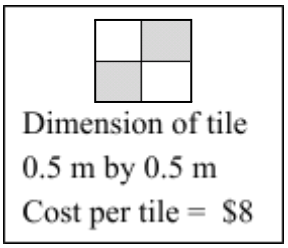
$1\ cm^2 : \frac{124}{31}\ m^2$

$1\ cm^2 : 4\ m^2$

$1\ cm : 2\ m$ √A1

Answer n = ……..…… [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,

Length = 6.1 × 2 = 12.2 m	No of tiles = 25
Length = 6.2 × 2 = 12.4 m	No of tiles = 25
Length = 6.3 × 2 = 12.6 m	No of tiles = 26
Width = 4.9 × 2 = 9.8 m	No of tiles = 20
Width = 5 × 2 = 10 m	No of tiles = 20
Width = 5.1 × 2 = 10.2 m	No of tiles = 21

A1

No of tiles = 20 × 25=500, 20 × 26=520, 21 × 25=525, 21 × 26=546

Answer ……..…… [1]

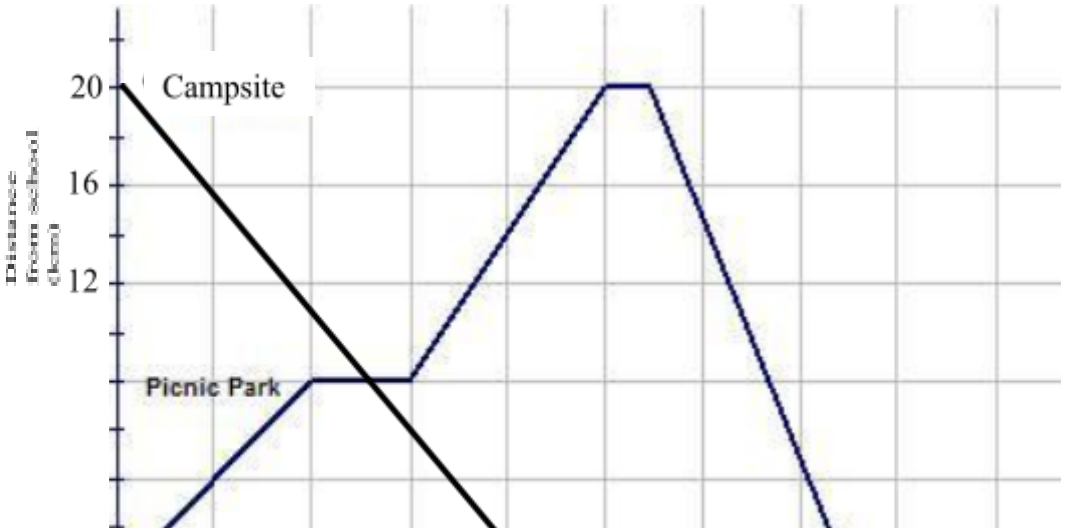
(ii) the cost of buying the tiles .

Cost = 500 × $8=$4000, 520 × $8=$4160, 525 × $8=$4200, 546 × $8=$4368

A1

Answer $ ……..…… [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.

M1A1

Answer ……12…… km/h [2]

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

Answer ……1115…… [B1]

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

Answer ……10…… km [B1]

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

Answer ……15…… minutes [B1]

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

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

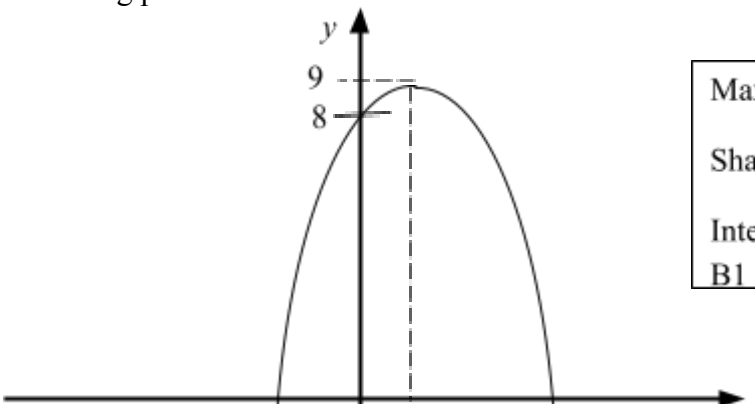
Accept $2\frac{2}{9}, 2.22$

B1

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.



Max pt M1

Shape B1

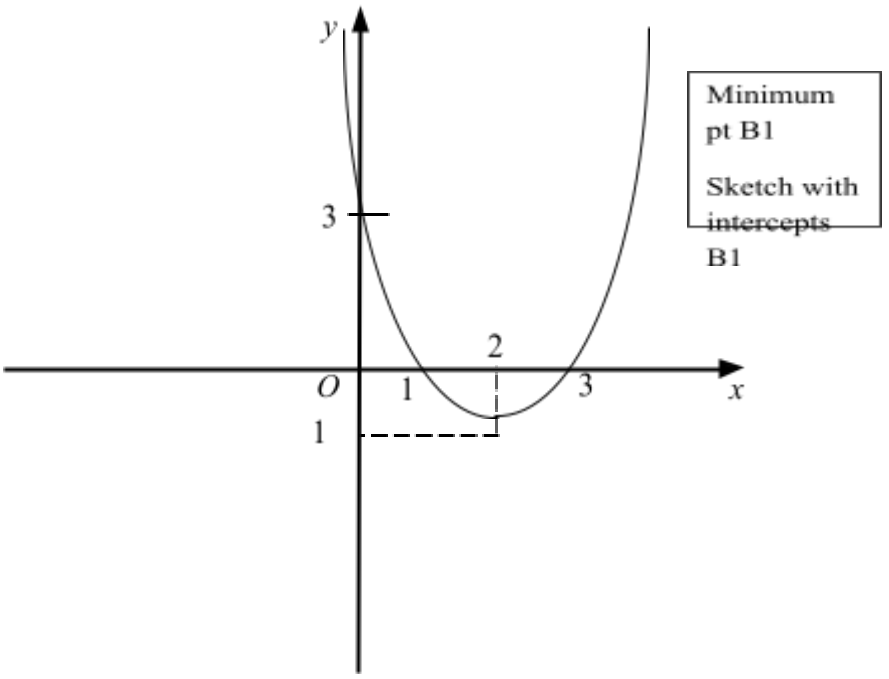
Intercepts B1

[Turn over

2 1 4

[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.

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

Answer ……..…… [1]

A second button is chosen at random.

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

$\frac{8-n}{8}\times\frac{7-n}{7}$ 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

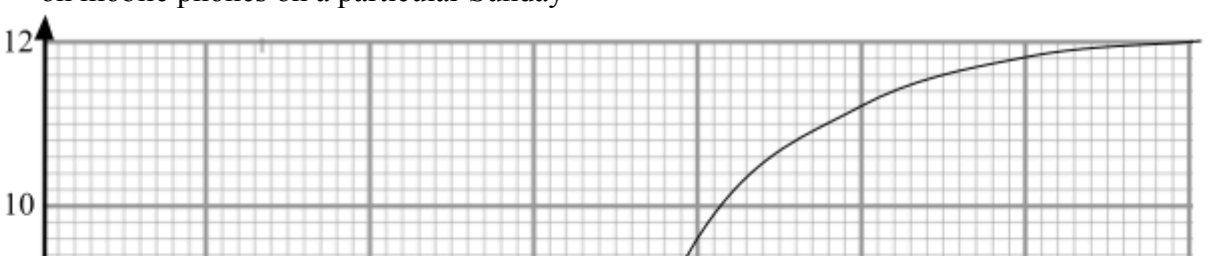
$n=10$ (rejected) or n = 5 B1

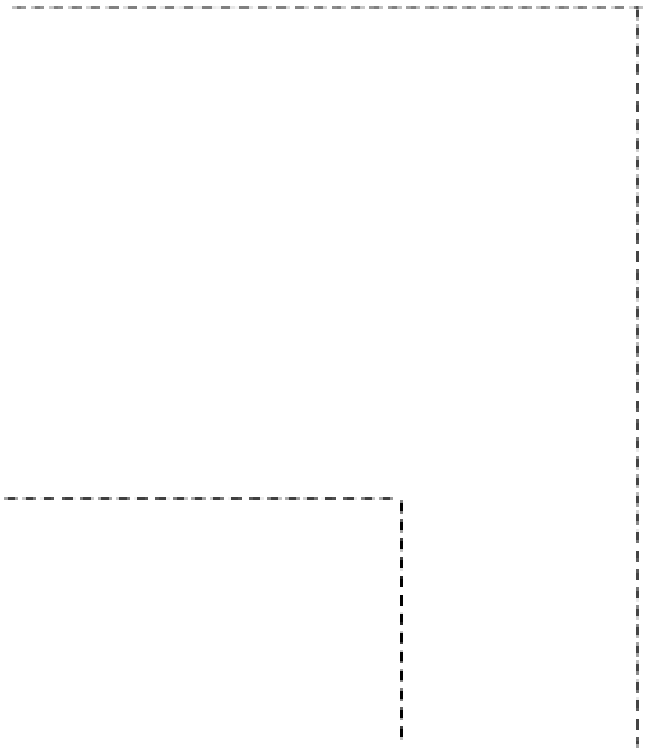
No of black buttons = 3 A1

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,

Median = 4.2 B1

Answer …… h [1]

(ii) the interquartile range.

IQR = 4.85 − 3.4 M1

= 1.45 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

2	2			
3	0	4	7	
4	1	5		
5	3	8	8	9
6	5			
7				
8				
9	2			

Key: 2 | 2 represents 2.2 hours

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

$$\text{Median} = \frac{4.5 + 5.3}{2}$$

$= 4.9$ B1

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 ……

……

……[1]

End of Paper