Solution

SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE

SECONDARY 4
2025 PRELIMINARY EXAMINATION

MATHEMATICS
Paper 1 **4052/01**

26 August 2025 (Tuesday) **2 hour 15 minutes**

CANDIDATE NAME

CLASS S 4 –

INDEX NUMBER

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your full name, class and index number in the spaces above.
Write in dark blue or black pen in the space provided for each question.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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

If working is needed for any question, it must be shown in the space below the question.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 90.

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.

For Examiner's Use		
Q1	2	
Q2	4	
Q3	4	
Q4	6	
Q5	2	
Q6	3	
Q7	4	
Q8	3	
Q9	3	
Q10	3	
Q11	2	
Q12	4	
Q13	4	
Q14	2	
Q15	4	
Q16	6	
Q17	5	
Q18	5	
Q19	4	
Q20	6	
Q21	2	
Q22	8	
Q23	4	
Total	**90**	

Mathematical Formulae

Compound Interest

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer all the questions.

1. $\xi = \{\text{ integers } x : 3 < x < 18 \}$

$P = \{\text{multiples of } 5\}$

$Q = \{\text{perfect squares}\}$

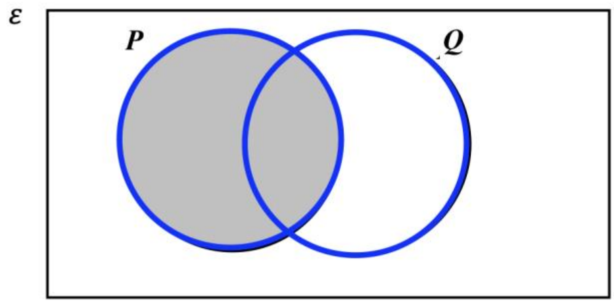
(a) List the elements in $(P \cup Q)'$.

$P \cup Q = \{4, 5, 9, 10, 15, 16\}$
$(P \cup Q)' = \{6, 7, 8, 11, 12, 13, 14, 17\}$

Answer .... [1]

(b) On the Venn diagram, shade the region which represents $(P \cap Q) \cup (P \cap Q')$.

Answer



[1]

2. **(a)** Use prime factors to explain why 18×63 is not a perfect square.

Answer

$18 = 2 \times 3^2$
$63 = 7 \times 3^2$
$18 \times 63 = 2 \times 3^2 \times 7 \times 3^2$
$18 \times 63 = 2 \times 3^4 \times 7$

Since the indices of the prime factors of 18×63 are not all even numbers, 18×63 is not a perfect square.

……………………………………………………………………………………

……………………………………………………………………………………

…………………………………………………………………………………… [2]

(b) The number $18p$ is a perfect cube.
Find the smallest positive integer value of p.

$18 = 2 \times 3^2$
$18p = 2 \times 3^2 \times p$
$p = 2^2 \times 3$
$p = 12$

Answer $p =$……………………… [2]

3. **(a)** Given that $2^{m-1} \times 3^m = 1$, find the value of 36^m .

$$2^{m-1} \times 3^m = 1$$
$$2^m \times 3^m = 2$$
$$6^m = 2$$
$$36^m = 2^2$$
$$36^m = 4$$

Answer $36^m =$ ……………………… [2]

(b) Simplify $\dfrac{(2xy)^{-2}}{12} \div \dfrac{x^3}{4y^2}$.

$$\frac{(2xy)^{-2}}{12} \div \frac{x^3}{4y^2}$$
$$= \frac{1}{48x^2y^2} \times \frac{4y^2}{x^3}$$
$$= \frac{1}{12x^5}$$

Answer …………………………… [2]

4. **(a)** Solve the equation $x^2 - 4x - 11 = 0$ by completing the square.
Give your answer correct to 2 decimal places.

$$x^2 - 4x - 11 = 0$$
$$(x^2 - 4x + 2^2 - 2^2) - 11 = 0$$
$$(x-2)^2 - 4 - 11 = 0$$
$$(x-2)^2 = 15$$
$$x - 2 = \pm\sqrt{15}$$
$$x = 2 \pm \sqrt{15}$$
$x = 5.87\ (2\ d.p.)$ or $x = -1.87\ (2\ d.p.)$ [

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

(b) **(i)** Factorise completely $4x^2 + 5x - 6$.

$$4x^2 + 5x - 6 = (4x - 3)(x + 2)$$

Answer ………………..…………………..…… [1]

(ii) Hence, factorise completely $4(2t+2)^2 + 5(2t+2) - 6$.
Write your answer as simply as possible.

$$4(2t+2)^2 + 5(2t+2) - 6$$
$$= [4(2t+2) - 3][(2t+2) + 2]$$
$$= (8t+5)(2t+4)$$
$$= 2(8t+5)(t+2)$$

Answer ………………..…………………..…… [2]

5. It is given that y is directly proportional to x^2.
Find the percentage increase in y if x is increased by 25% of its original value.

$y = kx^2$, where k is a constant
$Let\ new\ x = x_1$
$Let\ new\ y = y_1$
$x_1 = 1.25x$
$y_1 = k(1.25x)^2$
$y_1 = 1.5625kx^2$

Percentage increase in y
$= \frac{y_1 - y}{y} \times 100\%$
$= \frac{1.5625kx^2 - kx^2}{kx^2} \times 100\%$
$= \frac{kx^2(1.5625 - 1)}{kx^2} \times 100\%$
$= 56.25\ \%$

Answer ……………………..…… % [2]

6. Express as a single fraction in its simplest form

$$\frac{4(x-2)}{x^2-4} - \frac{2(3x-1)}{3x^2+5x-2}\ .$$

$\frac{4(x-2)}{x^2-4} - \frac{2(3x-1)}{3x^2+5x-2}$
$= \frac{4(x-2)}{(x-2)(x+2)} - \frac{2(3x-1)}{(3x-1)(x+2)}$
$= \frac{4}{x+2} - \frac{2}{x+2}$
$= \frac{2}{x+2}$

Answer ………………..…………….……. [3]

[Turn over

7. In the sequence, the difference between any two consecutive terms is the same number.

17 $\quad x \quad y \quad z \quad$ 9 $\quad \ldots$

(a) Find the values of x, y and z.

$T_1 = 17$
$T_2 = x = 17 + 1(-2) = 15$
$T_3 = y = 17 + 2(-2) = 13$
$T_4 = z = 17 + 3(-2) = 11$
$T_5 = 23 = 17 + (5 - 1)(-2) = 9$

Alternative method

Common difference = 2
$x = 17 - 2 = 15$
$y = 17 - 4 = 13$
$z = 17 - 6 = 11$

Answer x = ……………………

y = ……………………

z = …………………… [2]

(b) Write down an expression for the nth term of the sequence.

$T_n = 17 + (-2)(n - 1)$
$T_n = 19 - 2n$

Answer …………………………………… [1]

(c) Explain why -317 is a term of this sequence.

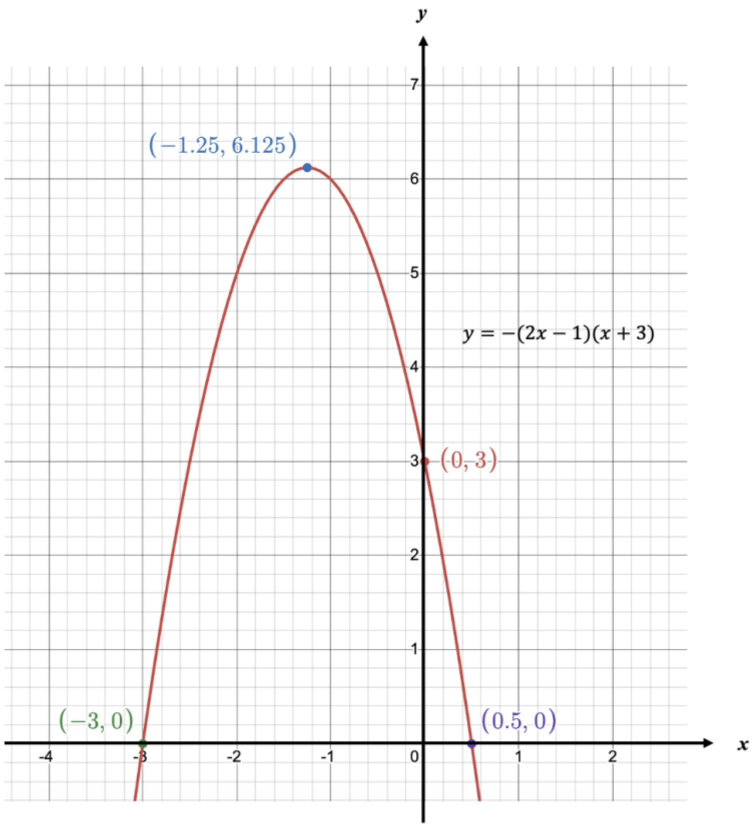
Answer
$19 - 2n = -317$
$n = 168$
Since n is a positive integer, -317 is the 168th term of the sequence.

OR Since n is a positive integer, -317 is a term of the sequence.

……………………………………………………………………………

[1]

8. Sketch the graph of $y = -(2x - 1)(x + 3)$ on the axes below.
Indicate clearly the coordinates of the turning point and where the graph crosses the axes.



[3]

9. Diana has two outlets that sell donuts of three flavours.
The number of donuts sold in the outlets over a two-hour period is given by the matrix ***D***.

$$\mathbf{D} = \begin{array}{c} \begin{array}{ccc} \text{Blueberry} & \text{Chocolate} & \text{Apple} \end{array} \\ \begin{pmatrix} 75 & 86 & 48 \\ 108 & 56 & 36 \end{pmatrix} \end{array} \begin{array}{l} \\ Outlet\ 1 \\ Outlet\ 2 \end{array}$$

(a) Each blueberry donut is sold at \$3.50.
Each chocolate donut is sold at \$4.50.
Each apple donut is sold at \$2.50.

Represent the selling price in a 3 × 1 column matrix **P**.

$$\mathbf{P} = \begin{pmatrix} 3.5 \\ 4.5 \\ 2.5 \end{pmatrix}$$

Answer **P** = ... [1]

(b) Evaluate the matrix **M** = **DP**.

$$\begin{aligned} &\mathbf{M} \\ &= \mathbf{DP} \\ &= \begin{pmatrix} 75 & 86 & 48 \\ 108 & 56 & 36 \end{pmatrix} \begin{pmatrix} 3.5 \\ 4.5 \\ 2.5 \end{pmatrix} \\ &= \begin{pmatrix} (75 \times 3.5) + (86 \times 4.5) + (48 \times 2.5) \\ (108 \times 3.5) + (56 \times 4.5) + (36 \times 2.5) \end{pmatrix} \\ &= \begin{pmatrix} 769.5 \\ 720 \end{pmatrix} \end{aligned}$$

Answer **M** = ... [1]

(c) Explain what each element in matrix **M** represents.

769.5 represents the total amount in dollars collected by Diana from selling donuts of the 3 flavours in outlet 1 over a two-hour period.

720 represents the total amount collected in dollars by Diana from selling donuts of the 3 flavours in outlet 2 over a two-hour period.

Answer .... [1]

10. A bag contains some blue marbles, some green marbles and some red marbles.

The probability of choosing a green marble is 0.2 .

The probability of choosing a red marble is 0.35 .

(a) Find the probability of choosing a blue marble at random.

P (blue marble)
= 1 – 0.35 – 0.2
= 0.45

45% : not accepted

Answer ……………….…….   [1]

(b) In the bag, there are 9 more red marbles than green marbles.

Find the total number of marbles in the bag.

Total number of marbles in the bag

$$= \frac{9}{0.35 - 0.2}$$

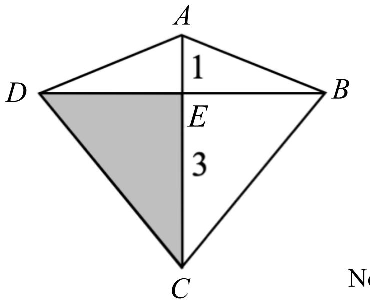
$$= 60$$

Answer ……………..… marbles   [2]

11. The diagram shows a kite *ABCD*.

AC and *AB* are the diagonals of the kite.

E is a point on *AC* such that *AE* : *EC* = 1 : 3.



Not drawn to scale

Find the fraction of the kite that is shaded.

$$\frac{Area\ of\ smaller\ triangle}{Area\ of\ bigger\ triangle} = \frac{\frac{1}{2} \times B \times H1}{\frac{1}{2} \times B \times H2}$$

$$\frac{Area\ of\ smaller\ triangle}{Area\ of\ bigger\ triangle} = \frac{1}{3}$$

$$\frac{Area\ of\ Shaded\ triangle}{Diagram}$$

$$= \frac{1.5}{4} = \frac{3}{8}$$

<u>Alternative Solution</u>

Let the height of the smaller triangle be H_1.
Let the height of the larger triangle be H_2.
$H_2 = 3H_1$

Fraction of the kite that is shaded

$$= \frac{\frac{1}{2}\left(\frac{1}{2}\times H_2 \times B\right)}{\left(\frac{1}{2}\times H_1 \times B\right)+\left(\frac{1}{2}\times H_2 \times B\right)}$$

$$= \frac{\frac{1}{2}\left(\frac{1}{2}\times 3H_1 \times B\right)}{\left(\frac{1}{2}\times H_1 \times B\right)+\left(\frac{1}{2}\times 3H_1 \times B\right)}$$

$$= \frac{\frac{1}{2}\left(\frac{1}{2}\times 3H_1 \times B\right)}{\left(\frac{1}{2}\times H_1 \times B\right)(1+3)}$$

$$= \frac{3}{8}$$

Answer ……………………..…% [2]

12. **(a)** Ben sold a painting to Carl at a profit of 20% and Carl then sold it to Don at a profit of 40%. If Don paid \$12800 for the painting, calculate how much Ben paid for the painting.

Let the cost of the painting be \$$x$.

$\frac{140}{100}\left(\frac{120}{100}x\right) = 12800$

$1.4 \times 1.2x = 12800$

$1.68x = 12800$

$x = \frac{12800}{1.68}$

$x = 7619.05$ (2 d.p).

Answer \$.............................. [2]

(b) Some bacteria were introduced into a culture.

The number, N, of bacteria, t hours after being introduced is given by $N = 2 \times 5^t$.

Find the increase in the number of bacteria after 5 hours as a percentage of the number of bacteria originally introduced.

Percentage increase in the number of bacteria at the end of 5 hours

$= \frac{2\times5^5 - 2\times5^0}{2\times5^0} \times 100\%$

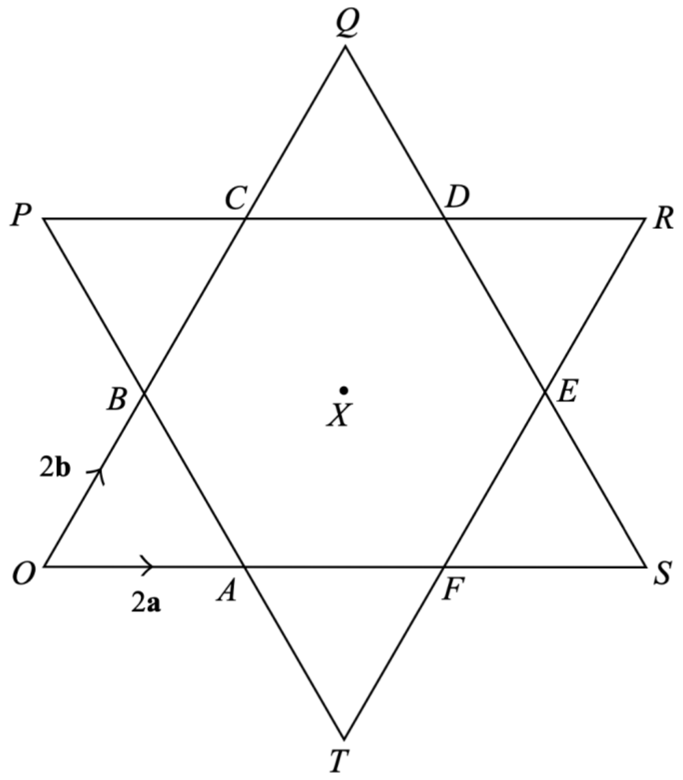
$= \frac{2(5^5 - 1)}{2} \times 100\%$

$= 3124 \times 100\%$

$= 312400\%$

Answer ....% [2]

13.



A star is made up of a regular hexagon *ABCDEF*, centre *X*, surrounded by equilateral triangles.
$\overrightarrow{OA} = 2\boldsymbol{a}$ and $\overrightarrow{OB} = 2\boldsymbol{b}$.

(a) Express the following vectors in terms of **a** and / or **b**, giving your answers in the simplest form.

(i) $\overrightarrow{OR}$
$\overrightarrow{OR} = \overrightarrow{OA} + \overrightarrow{AF} + \overrightarrow{FE} + \overrightarrow{ER}$
$\overrightarrow{OR} = 4\boldsymbol{a} + 4\boldsymbol{b}$

Answer ……………………… [1]

(ii) $\overrightarrow{FC}$
$\overrightarrow{FC} = \overrightarrow{FE} + \overrightarrow{ER} + \overrightarrow{RD} + \overrightarrow{DC}$
$\overrightarrow{FC} = 4\boldsymbol{b} - 4\mathbf{a}$

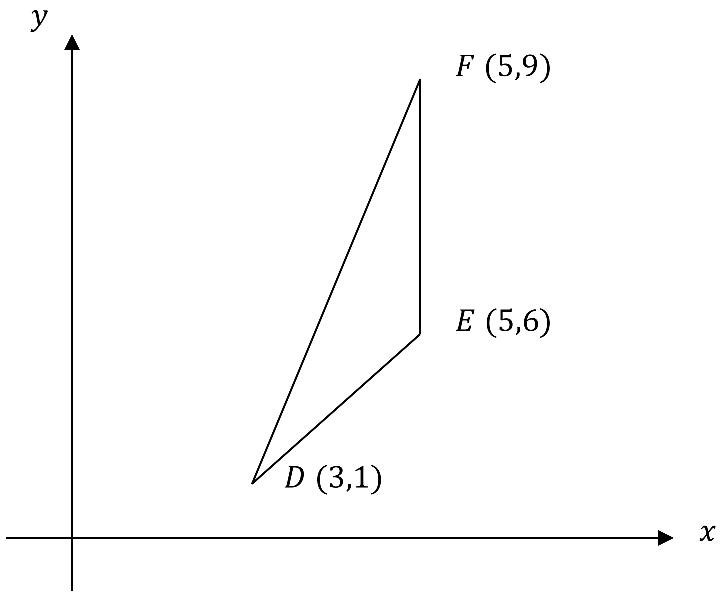
Answer ……………………… [1]

(b) When $|\boldsymbol{a}| = 6$ units, find the perimeter of the star *OATFSERDQCPBO*.

Perimeter of the star
= 12 (2 x 6)
= 144 units

Answer ……………. ….units [2]

14. The diagram shows the points $D\ (3,1)$, $E\ (5,6)$ and $F\ (5,9)$.



(a) Find the coordinates of G such that $DEFG$ is a parallelogram.

G (3 , 4)

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

(b) Find the length of the line DF.

DF

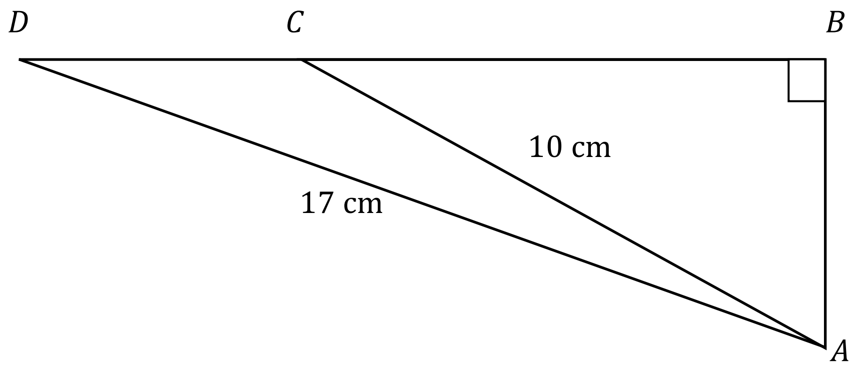
$= \sqrt{(5-3)^2 + (9-1)^2}$

$= 8.2462$

$= 8.25$ units (3 s.f.)

Answer DF =......................units [1]

15. In the triangle ABD, $AD = 17$ cm, $AC = 10$ cm and $\angle ABC = 90°$.



(a) Given that $sin\angle ACD = \frac{3}{5}$, find the exact value of

(i) AB

$$sin\angle ACD = sin\angle ACB = \frac{3}{5}$$
$$\frac{AB}{AC} = \frac{AB}{10} = \frac{3}{5}$$
$$AB = 6 \text{ cm}$$

Answer ……………………………… [1]

(ii) $tan\ \angle ACB$

$$BC = \sqrt{10^2 - 6^2} = 8 \text{ cm}$$
$$tan\ \angle ACB = \frac{AB}{BC} = \frac{6}{8} = \frac{3}{4}$$

Answer ……………………………… [2]

(b) A circle Q_1 is drawn such that it passes through A, B and C.
A second circle Q_2 is drawn such that is passes through A, B and D.
Find the ratio of the circumference of Q_1 to circumference of Q_2.

Note that AC is the diameter of Q_1 (right angle in a semicircle)
And AD is the diameter of Q_2 (right angle in a semicircle)

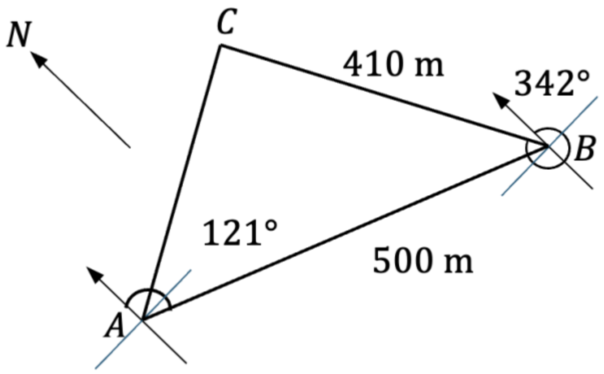
Therefore
$$\frac{\text{circumference of } \mathrm{Q}_1}{\text{circumference of } \mathrm{Q}_2} = \frac{10}{17}$$

The ratio of the circumference of Q_1 to circumference of Q_2 is 10 : 17.

Answer …………… : …………. [1]

16. Aris cycled from his house at Alley Way, point A, to meet Meng at point B, which is 500 m away on a bearing of 121°.

After that, they both cycled to the School of Science and Technology (SST), point C , on a bearing of 342°, which is 410 m from B.



(a) Show that angle ABC is 41°.

$\angle ABN = 180° - 121° = 59°$ (interior angles, parallel lines)
$\angle CBN = 360° - 342° = 18°$ (angles at a point)

$\therefore \angle ABC = 59° - 18° = 41°$ $(adjacent\ angles)$ (shown)

[2]

(b) Calculate the distance AC.

$$AC^2 = AB^2 + BC^2 - 2(AB)(BC)cos41°$$
$$AC^2 = 500^2 + 410^2 - 2(500)(410)cos41°$$
$AC = 329.64 = 330$ m (correct to 3 significant figures)

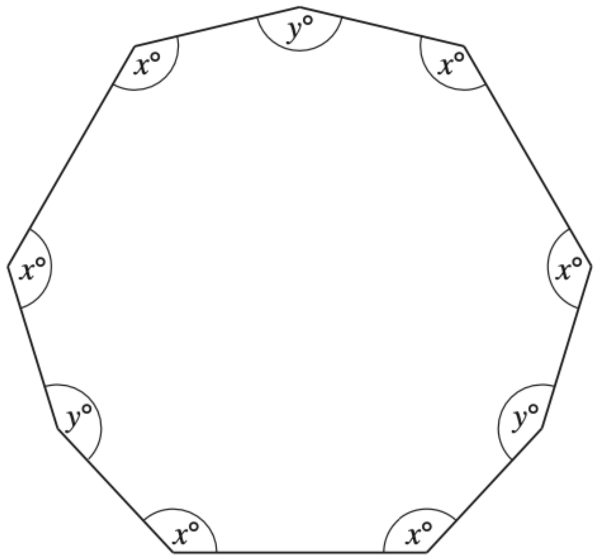
Answer .... m [2]

(c) Calculate the shortest distance from A to BC..

Let the shortest distance from A to BC be h.
$$sin\angle ABC = \frac{h}{500}$$
$$h = 500 \sin 41°$$
$h = 328.02 = 328$ m (correct to 3 significant figures)

Answer .... m [2]

17. The diagram shows a nonagon.
Six interior angles are each $x°$. The remaining three interior angles are each $y°$.



(a) State the number of lines of symmetry if $x° \neq y°$.

Lines of symmetry = 3

Answer ……………………… [1]

(b) Find the sum of the interior angles of the nonagon.

$(9 - 2) \times 180° = 1260°$

Answer ………………………° [1]

(c) Hence, show that $y = -2x + 420$.

Use $6x° + 3y° = 1260°$
$y = -2x + 420$ (shown)

[1]

(d) Given that $x : \text{y} = 13 : 16$, find x.

$\frac{x}{y} = \frac{13}{16}$

$y = \frac{16}{13}x - - - - - - (1)$

Sub (1) into equation into $y = -2x + 420$

$-2x + 420 = \frac{16}{13}x$

$-26x + 5460 = 16x$

$42x = 5460$

$x = 130$

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

18. **(a)** Ellie went for a school exchange in the United Kingdom.
She changed 250 Singapore dollars ($) to UK pounds (£).
She spent £100 during her trip and converted the remaining pounds back to Singapore dollars.

Exchange Rate	Buying Rate for One Singapore Dollar ($)	Selling Rate for One Singapore Dollar ($)
UK Pounds (£)	0.5746	0.5830

Using the exchange rate given, calculate how much Singapore dollars she had left.
Give your answer to the nearest dollar.
Selling rate of UK pounds: SGD 1 = £ 0.5830
Conversion of SGD250 to pounds
$= \$250 \times 0.580$
= £ 145.75 (2 d.p.)

Buying rate of UK pounds: SGD 1 = £ 0.5746
Conversion of pounds to SGD
$= \$\ [(145.75 - 100) \div 0.5746]$
= $79.62
= $80 (to the nearest dollar).

Answer $ .... [2]

(b) Jane intends to borrow $88000 for her business venture and is considering the loan schemes by Bank *A* and Bank *B*.

Bank *A*	Bank *B*
Interest rate of 2.38% per annum compound interest compounded half-yearly	Interest rate of 3.28% per annum simple interest

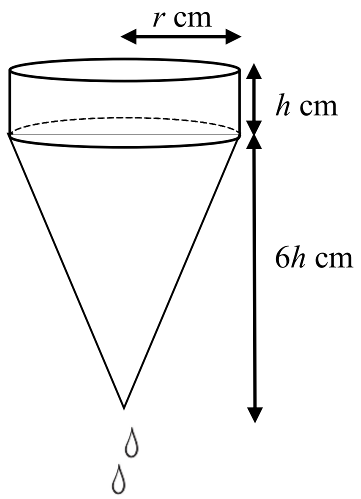
If Jane wishes to take a loan for a period of 5 years, determine which bank should she borrow from.
Explain your answer with mathematical calculations.

	Bank A	Bank B
Total amount to repay	Total $= \$88000\left(1 + \frac{\frac{2.38}{2}}{100}\right)^{5\times2}$ $= 88000\left(1 + \frac{1.19}{100}\right)^{10}$ = $99050.95 (2 d p.) [M1]	Total $= 88000 + 88000\left(\frac{3.28}{100} \times 5\right)$ $= 88000 + 14432$ = $102432 [M1]

Jane should borrow from Bank A as the total amount she has to repay is $99050.95 which is <u>less than</u> the total amount of $102432 from Bank B. [3]

19. A water tank is formed from a cylinder and a cone.
The cylinder has radius r cm and height h cm.
The cone has a base radius of r cm and height $6h$ cm.

The water tank is filled with water to the brim of the tank.
Water is drained out at a constant rate and the tank is completely emptied in 60 minutes.



(a) Find the time taken, in minutes, for the water in the cylinder to drain completely.

Answer

Volume of cylinder $= \pi r^2 h$

Volume of cone $= \frac{1}{3}\pi r^2 6h = 2\pi r^2 h$

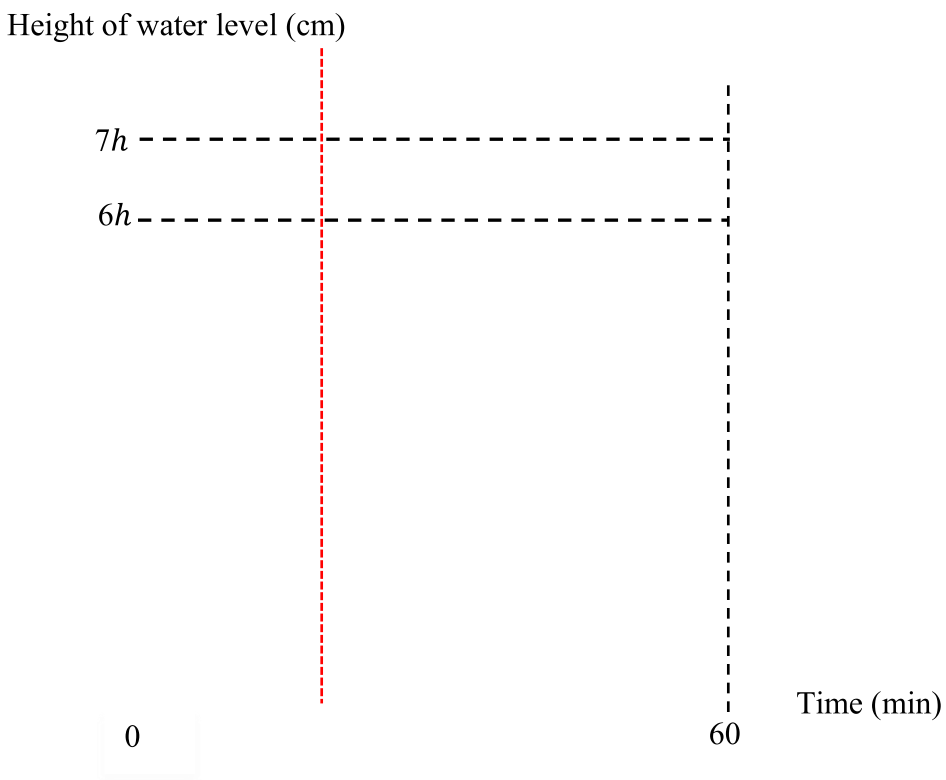
Time for water in the cylinder to leak completely

$= \frac{\pi r^2 h}{3\pi r^2 h} \times 60 = 20$ minutes

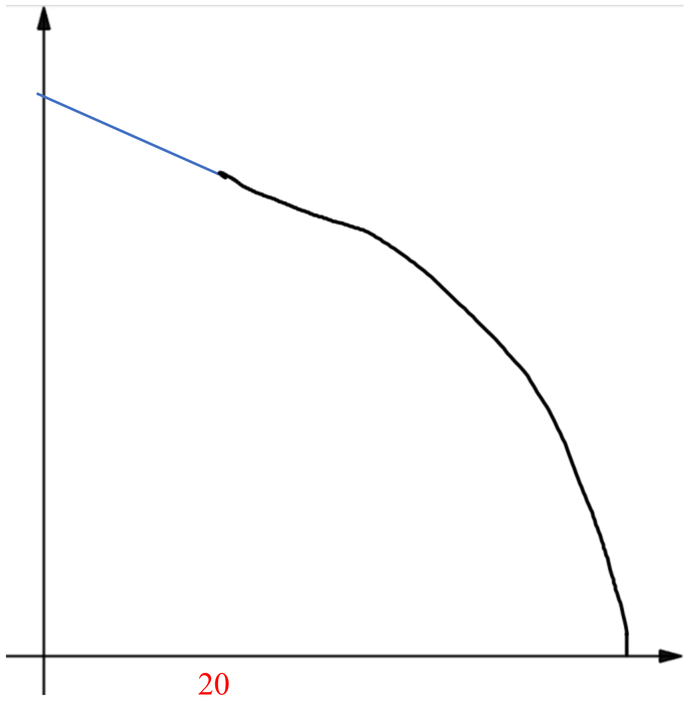
Answer ....mins [2]

(b) On the grid provided, sketch the graph of the height of the water level in the tank against the time taken (in min).

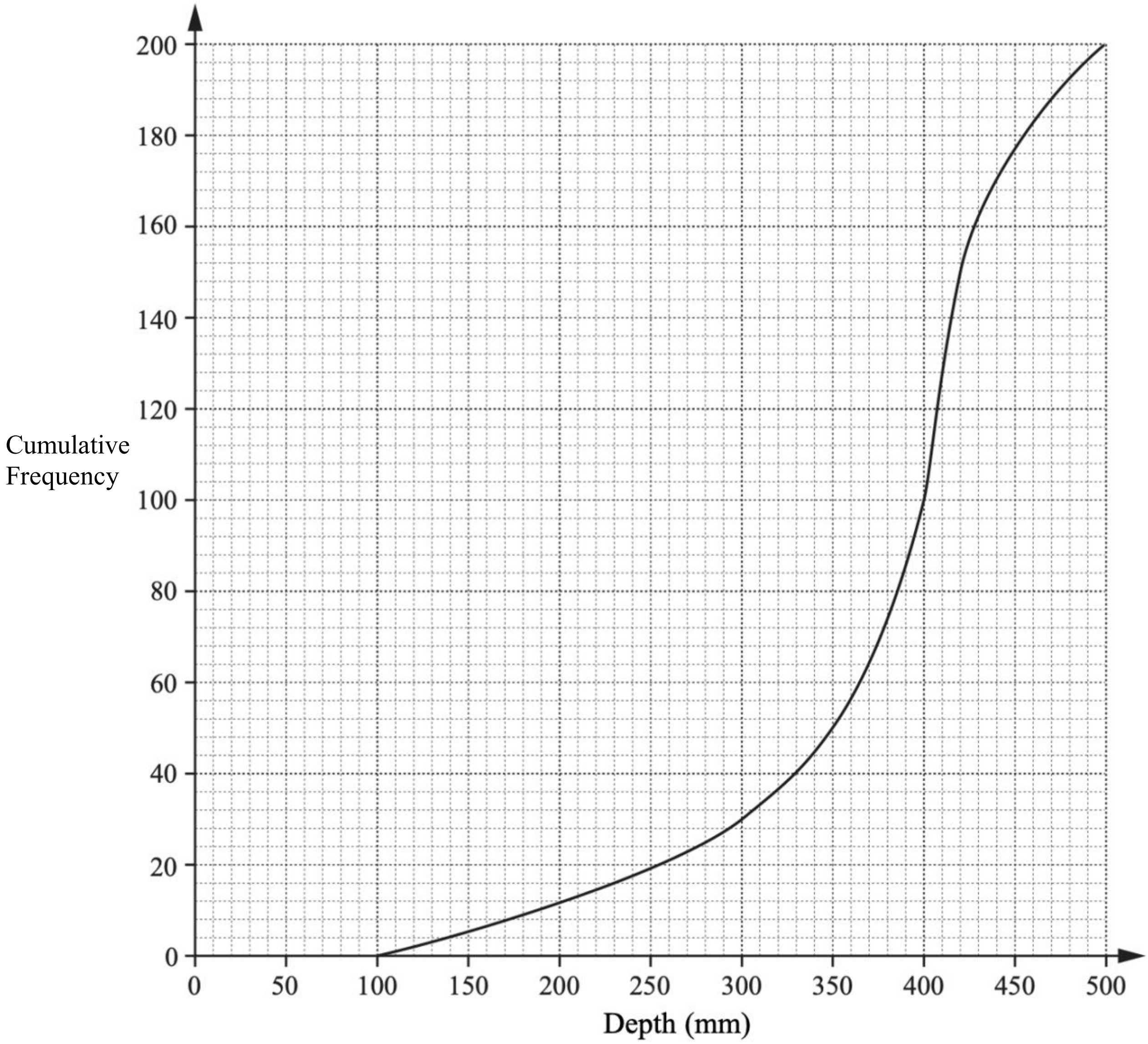
Answer



[2]



20. The cumulative frequency curve shows the distribution of the depth, *d* mm, of a canal measured daily for a period of 200 days.



(a) Use the curve to estimate

(i) the median depth of the canal,

Median = 400 mm.

Answer ……………………… mm [1]

(ii) the interquartile range of the depth ,
IQR
= 420 – 350
= 70 mm

Answer ……………………… mm [1]

(iii) the depth at the 30th percentile,

Reading at 60 days = 365 mm

Answer ………………………. mm [1]

(iv) the number of days when the depth of the canal was at least 450 mm.

Number of days when the depth of the canal was at least 450 mm
= 200 – 178
= 22

Answer ………………………. days [1]

(b) The information on the cumulative frequency curve is shown in this table.

Depth (mm)	$100 < d \leq 200$	$200 < d \leq 300$	$300 < d \leq 400$	$400 < d \leq 500$
No. of days	12	m	n	100

(i) Find the values of m and n.

$m = 30 - 12 = 18$
$n = 70$

Answer $m =$ ……… $n =$………. [1]

(ii) Calculate an estimate of the mean depth of the canal.

Estimated mean

$$= \frac{(150 \times 12) + (250 \times 18) + (350 \times 70) + (450 \times 100)}{200}$$

$$= \frac{1800 + 4500 + 24500 + 45000}{200}$$

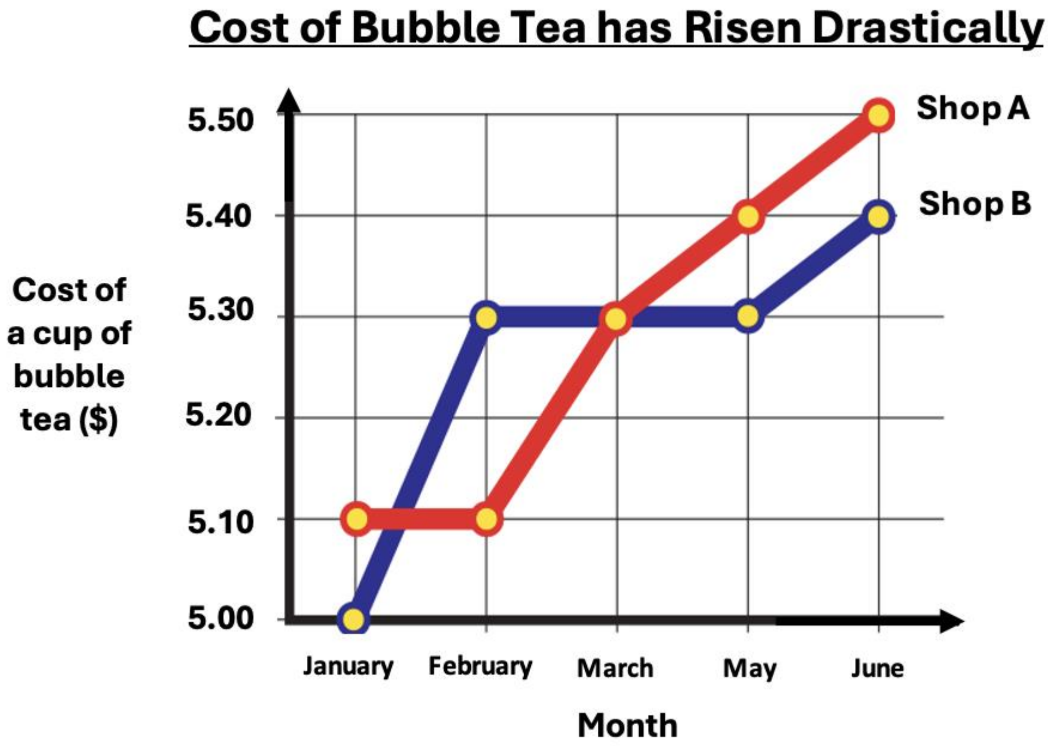
$$= \frac{77000}{200}$$

= 379 mm

Answer …………………….mm [1]

21.

[Turn over



State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

Answer

Possible answers:

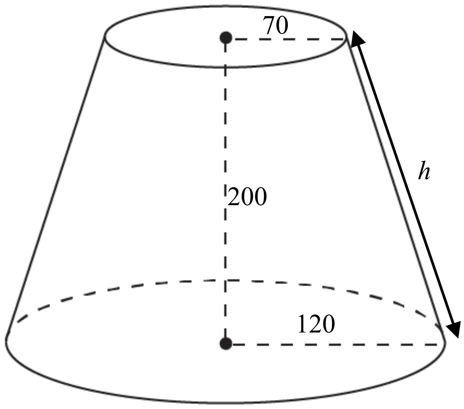
(i) The vertical axis did not start from zero. This exaggerates the differences between the price difference of $0.10.

(ii) The title is biased. This misguides the readers to think that the price of bubble tea has increased significantly and does not allow readers to make their own judgement.

(iii) Information from the month of April is missing. The reader may assume that the price of bubble tea for Shop B has remained constant compared to the the price of bubble tea for Shop A which has increased.

[2]

22.



The diagram shows a lampshade in the shape of a frustum.
The bottom radius of the frustum is 120 mm.
The top radius of the frustum is 70 mm.
The vertical height of the frustum is 200 mm.

(a) Find the slant height *h* of the frustum.
Answer

Slant height
$= \sqrt{(120-70)^2 + 200^2}$
use of Pythagoras' Theorem
$= \sqrt{42500}$
$= 206.15$
$= 206$ mm (3 significant figures)

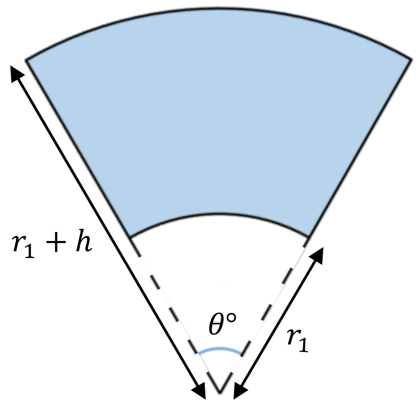
Answer ……………………….…… mm [2]

(b) The shaded area represents the net of the lampshade.

The radius of the inner arc is r_1 mm.

The radius of the outer arc is $(r_1 + h)$ mm.

Show that the radius of the inner arc is 288.6 mm.



Answer

$\frac{\theta}{360°} \times 2\pi r_1 = 2\pi(70)$ ---- (1)

$\frac{\theta}{360°} \times 2\pi(r_1 + h) = 2\pi(120)$ ---- (2)

From (1),

$\frac{\theta}{360°} = \frac{2\pi(70)}{2\pi r_1}$

$\frac{\theta}{360°} = \frac{70}{r_1}$

From (2),

$\frac{\theta}{360°} = \frac{2\pi(120)}{2\pi(r_1+h)}$

$\frac{\theta}{360°} = \frac{120}{r_1+h}$

Hence,

$\frac{70}{r_1} = \frac{120}{r_1+\sqrt{42500}}$

$r_1 = 70\sqrt{17} = 288.6$ mm (shown)

[3]

(c) Hence, find angle θ.

Answer

$$\theta = \frac{2\pi(70) \times 360}{2\pi(70\sqrt{17})} = 87.312°$$

$$= 87.3° \text{ (1 d.p.)}$$

Answer $\theta°$ =……………………………° [1]

(d) Calculate the amount of material required to make the lampshade, leaving your answer in square centimeters.

Answer

Total surface area

$= \frac{87.312°}{360°} \times \pi\left(70\sqrt{17} + 50\sqrt{17}\right)^2$

$- \frac{87.312°}{360°} \times \pi\left(70\sqrt{17}\right)^2$

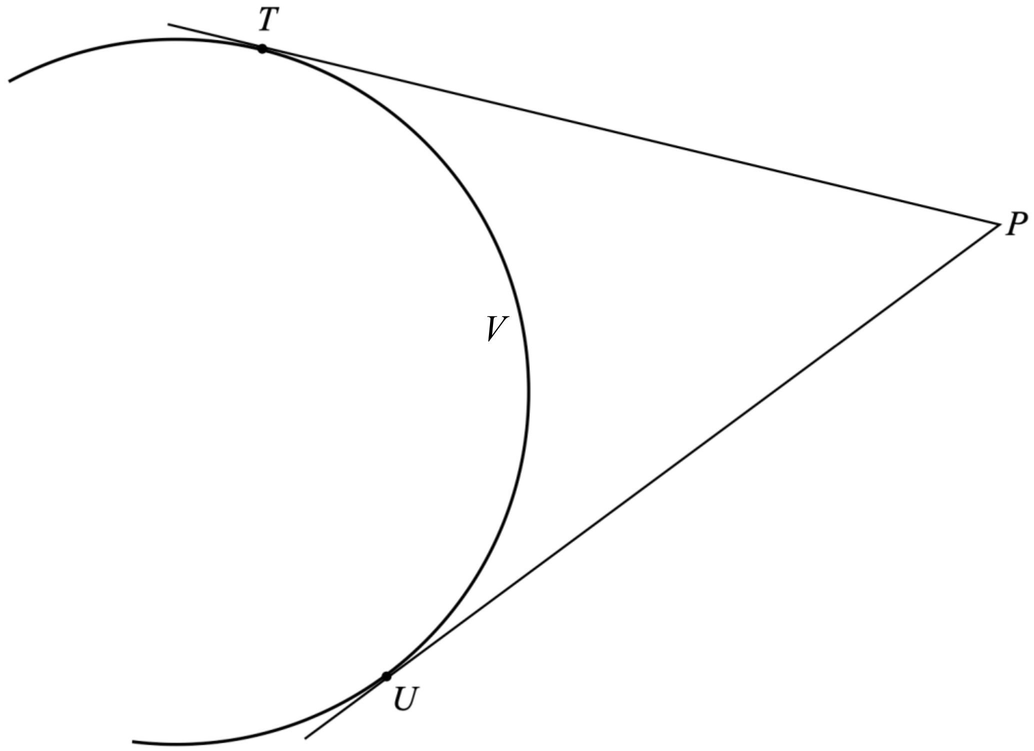
$= 123053.4615$ mm^2

$= 1230$ cm^2 (3 significant figures)

Answer ……………………………… cm^2 [2]

23. The diagram shows a plot of land, *PTVU*, on a campsite.

PT and *PU* are tangents of an arc of a circle at *T* and *U*.



(a) Find the center of the circle and label it *X*. [1]

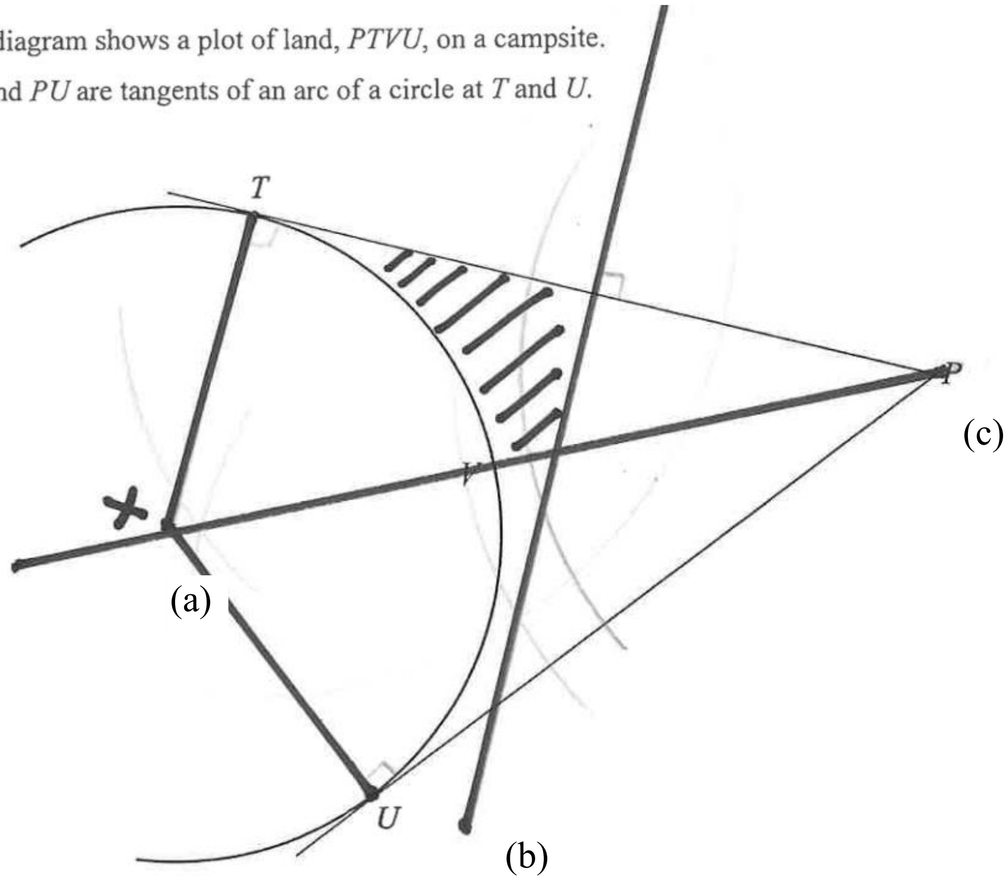
(b) Construct the perpendicular bisector of *TP*. [1]

(c) Construct the angle bisector of angle *TPU*. [1]

(d) A lookout tower is to be built on the campsite *PTVU*, nearer to *T* than *P* and nearer to *PT* than *PU*.

Shade the region where the lookout tower is to be built. [1]

23. The diagram shows a plot of land, *PTVU*, on a campsite.
PT and *PU* are tangents of an arc of a circle at *T* and *U*.



(a) Find the center of the circle and label it *X*.
- Construction of perpendicular lines at *T* and *U*
- Labelling of intersection of perpendicular lines at *T* and *U* as point *X*

(b) Construction of the perpendicular bisector of *TP* with working

(c) Construction of the angle bisector of angle *TPU* with working

(d) A lookout tower is to be built on the campsite *PTVU*, nearer to *T* than *P* and nearer to *PT* than *PU*.
Shading of the region where the lookout tower is to be built.

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