



PEICAI SECONDARY SCHOOL

SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

PRELIMINARY EXAMINATION 2026

CANDIDATE
NAME

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CLASS

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REGISTER NUMBER

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MATHEMATICS

Paper 1

4052/01

17 August 2026

2 hours 15 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 90.

For Examiner's Use

This document consists of **20** printed pages.

Setter: Mr Chua JK

[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 (a) Write down the first 6 digits of $\sqrt{\frac{2}{6.7^2} - (-2.5)^3}$ shown on the calculator.

Answer [1]

- (b) Round off your answer in (a), to 3 decimal places.

Answer [1]

- 2 Simplify $\frac{10x^2 - 23xy - 99y^2}{2x^2y - 9xy^2}$.

Answer [3]

- 3 Given that $5^x + 6(7^x)^0 = 31$, find the value of x .

Answer $x =$ [2]

[Turn over

- 4 Jayden deposited some money in a bank that pays a compound interest of 2.2% per annum, compounded half yearly.
After 3 years, Jayden withdrew a total of \$40 000.

Calculate the amount of money deposited by Jayden, correct to the nearest dollar.

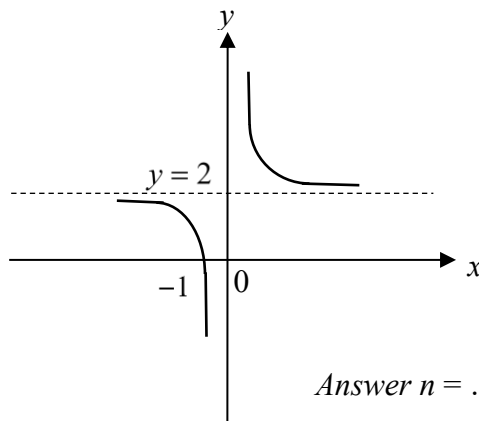
Answer \$ [2]

5 $\sin\left(\frac{1}{2}x^\circ\right) = 0.123$

Find two possible values of x in the range $0 \leq x \leq 360$.

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

- 6 The curve below has an equation $y = x^n + c$.
State a possible value of n and the value of c .



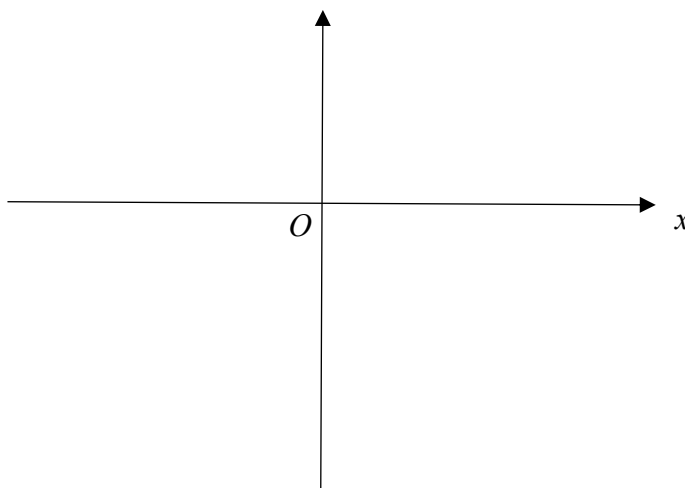
Answer $n = \dots\dots\dots$ [1]

$c = \dots\dots\dots$ [1]

- 7 (a) Express $x^2 + 4x - 10$ in the form $(x + p)^2 + q$.

Answer [1]

- (b) Sketch the graph of $y = x^2 + 4x - 10$ on the axes below.
Indicate clearly the coordinates of the turning point and the value of the y -intercept. [2]



- 8 A bag contains 10 red pens and 6 black pens.
Two pens are chosen from the bag at random without replacement.

Fred claims that the probability that one pen is a red pen and one pen is a black pen can be calculated using $\left(\frac{10}{16}\right)\left(\frac{6}{15}\right) = \frac{1}{4}$.

Explain why Fred's claim is not true and find the actual probability.

Answer because

..... [2]

9 Written as a product of its primes factors, $72 = 2^3 \times 3^2$.

(a) The number $72 \times 45 \times \frac{p}{q}$ is a perfect square where p and q are prime numbers.

Find the smallest value of $\frac{p}{q}$.

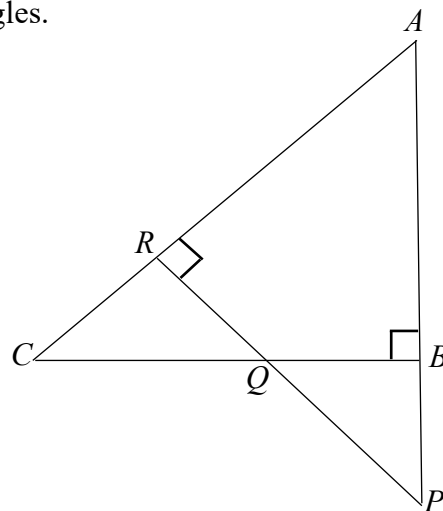
Answer $p = \dots\dots\dots$ or $q = \dots\dots\dots$ [2]

(b) Given that the highest common factor of 72 and m is $2^2 \times 3$, write down the two smallest possible value of m .

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

10 In the diagram shown below, it is given that $AP = 5$ cm, $BP = 2$ cm and $AR = 3$ cm. ARC , ABP and RQP are straight lines. Identify and prove a pair of congruent triangles.

Answer



[2]

- 11** The two containers are geometrically similar in shape.
The larger container has a capacity of 3328 ml and a surface area of 1008 cm².
The smaller container has a capacity of 1404 ml.

Calculate the surface area of the smaller container.

Answer cm² [3]

- 12** A shopping mall car park has a total of 168 cars and motorcycles.
Each car has 4 wheels and each motorcycle has 2 wheels.
There were 592 wheels altogether.
By forming a pair of simultaneous equations, find the number of cars.

Answer cars [3]

13

$$b = \sqrt{\frac{5c + 2a}{3a}}$$

- (a) Find b when $c = 18.02$ and $a = 0.71$.

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

- (b) Rearrange the formula to make a the subject.

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

14

- (a) An AI image generator creates 3.2×10^6 images on one day and 5.5×10^5 images on the next day. Calculate the total number of images generated over the two days, leaving your answer in standard form.

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

- (b) A data centre stores 9.6×10^{12} bytes of data.
Each video file has an average of 500 MB, where $1 \text{ MB} = 10^6$ bytes.
Calculate the maximum number of such video files that can be stored, leaving your answer in standard form.

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

- 15 (a)** $\varepsilon = \{x: x \text{ is an integer, } 11 < x < 21\}$
 $A = \{x: x \text{ is an odd number}\}$
 $B = \{x: x \text{ is a multiple of } 3\}$

(i) List the elements of Set A and of Set B .

Answer $A = \{\dots\dots\dots\}$ [1]

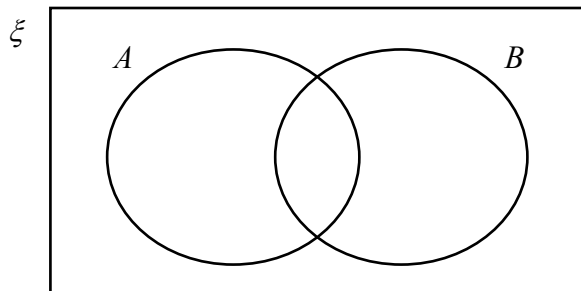
$B = \{\dots\dots\dots\}$ [1]

(ii) Find $n(A' \cap B)$.

Answer [1]

(b) On the Venn Diagram below, shade the set $A \cap B'$. [1]

Answer



16 Factorise completely.

(a) $x^2 - 6xy + 9y^2 - 16$

Answer [2]

(b) $4pq + 3r - 6qr - 2p$

Answer [2]

17 A map is drawn to a scale of 1 : 80 000.

- (a)** This scale can be expressed as 1 cm represents n km.
Find n .

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

- (b)** The distance between A and B on the map is 15 cm.
Find the actual distance, in kilometres, between A and B .

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

- (c)** A plot of land has an actual area of 10 km^2 .
Find the area, in square centimetres, of the plot of land on the map.

Answer $\dots\dots\dots$ cm^2 [2]

- 18 (a)** y is directly proportional to the cube root of x .
 It is given that $y = 50$ for a certain value of x .
 Find the value of y when this value of x decreased by 87.5%.

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

- (b)** A rectangular notice board is being redesigned. Its length is reduced by 20%, while its breadth is increased by 20%.

A student claims that the area of the notice board will remain unchanged because the percentage decrease and percentage increase are equal.

Determine whether the student's claim is correct. Support your answer with mathematical calculations.

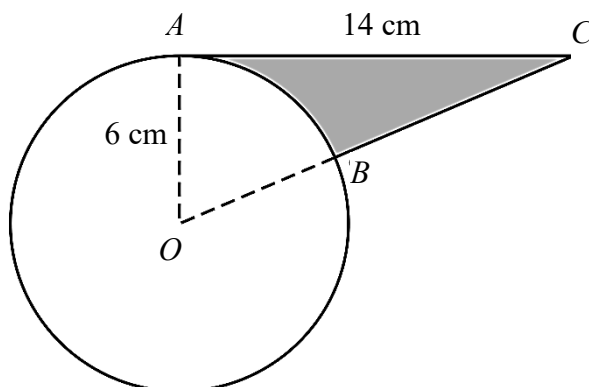
Answer $\dots\dots\dots$ because $\dots\dots\dots$
 $\dots\dots\dots$ [3]

- 19** Jude can pack 5 parcels in 6 hours.
Alyssa can pack 4 parcels in 5 hours.
They work together to pack 15 parcels.

Assuming they each work at a constant rate, calculate the time taken for them to pack all 15 parcels. Give your answer in hours and minutes, to the nearest minute.

Answer h min [3]

- 20** The diagram shows a circle, centre O and radius 6 cm. The tangent from C touches the circle at A and $AC = 14$ cm. The line from C to O cuts the circle at B .



- (a)** Show that angle AOB is approximately 1.17 radians.

[1]

- (b)** Find the perimeter of the shaded region.

Answer cm [3]

- 21** Tommy bought a car by hire purchase. The cash price of the car was \$93 500. He paid a deposit of \$9350 and the rest by equal monthly instalments over a period of 7 years. The bank charges a simple interest rate of 2.8% per annum on the amount loaned.

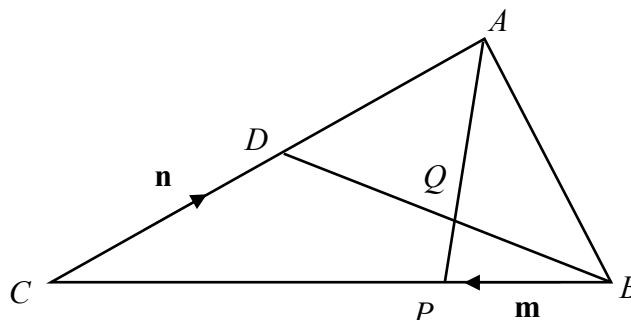
(a) Calculate the total interest charged.

Answer \$..... [2]

(b) Calculate Tommy's monthly instalment.

Answer \$..... [2]

- 22 In the diagram below, $\overrightarrow{BP} = \mathbf{m}$ and $\overrightarrow{CD} = \mathbf{n}$. $BC = 3BP$ and $AQ = 3PQ$.
 D is the midpoint of CA .



- (a) Express each of the following in terms of $\mathbf{m}$ and/or $\mathbf{n}$.
 Give your answers in their simplest form.

(i) $\overrightarrow{BD}$,

Answer [1]

(ii) $\overrightarrow{PA}$.

Answer [2]

- (b) Show that $\overrightarrow{BQ} = \frac{3}{2}\mathbf{m} + \frac{1}{2}\mathbf{n}$. [2]

Answer

- (c) Explain why B , Q , D lie in a straight line.

Answer

..... [2]

- (d) Calculate $\frac{\text{area of triangle } BAQ}{\text{area of triangle } BAP}$.

Answer [1]

- 23** The numbers are arranged in ascending order, where x is an integer.

5, 8, 9, 9, x , 12, 15, 18

- (a) Given that 9 is the mode, find the smallest possible value of x .

Answer $x =$ [1]

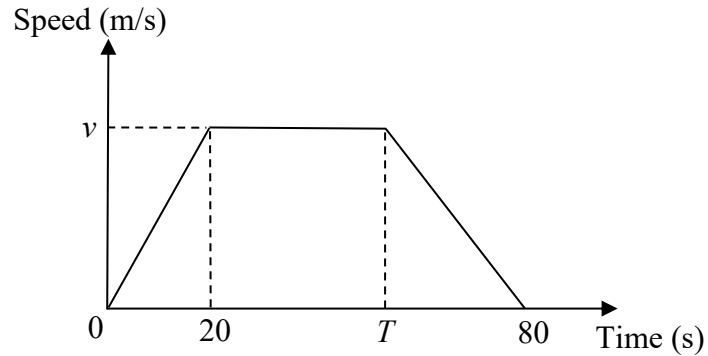
- (b) Given that the median is greater than the mode, find a possible value of x .

Answer $x =$ [1]

- 24** The diagram below shows the speed-time graph of a bus journey.

The bus accelerated from rest at 1.5 m/s^2 to a speed of $v \text{ m/s}$ in 20 seconds, and travelled at this speed until T seconds before it came to a stop at 80 seconds.

The total distance travelled for the whole journey was 1650 m.



- (a)** Find the value of

(i) v ,

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

(ii) T .

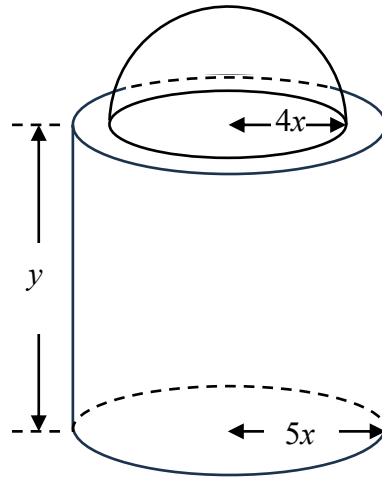
Answer $T = \dots\dots\dots$ [2]

- (b)** Describe the motion of the bus between 20 seconds and T seconds.

Answer $\dots\dots\dots$

$\dots\dots\dots$ [1]

- 25** A thermos flask is modelled by a cylinder and a hemisphere, as shown in the diagram. The cylinder has a radius of $5x$ cm and a height of y cm. The hemisphere has a radius of $4x$ cm.



- (a)** Show that the total volume, V , of the flask, in terms of x , y and π is

$$V = 25\pi x^2 y + \frac{128}{3}\pi x^3. \quad [2]$$

- (b)** Given the total volume is 2700π and $x = 1.5$, find the value of y .

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

- (c) The flask is covered with a layer of insulating material over the entire external surfaces, including the flat base. The insulating material costs \$0.002 per cm^2 . Using your answer in part (b), calculate the total cost of covering the flask.

Answer \$ [3]

- 26** A plot of land is in the shape of a quadrilateral $PQRS$, such that $QR = 8$ cm, angle $PQR = 81^\circ$ and $PS = RS = 9.8$ cm. PQ has been drawn for you.

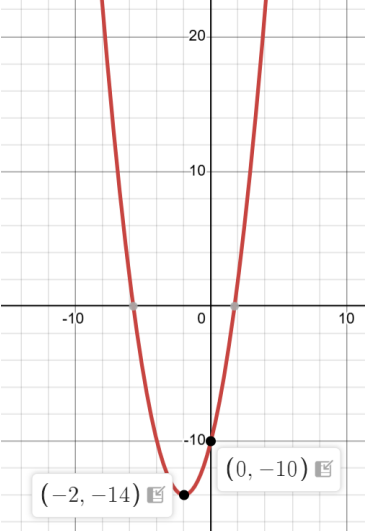
(a) Construct the quadrilateral. [2]



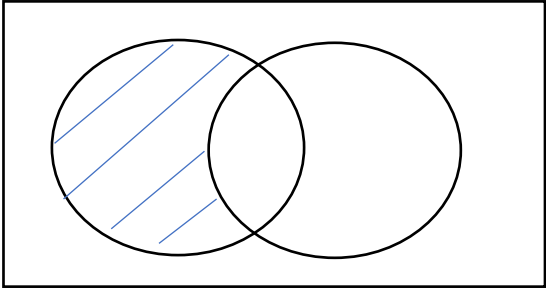
- (b)** Construct the perpendicular bisector of PQ . [1]
- (c)** Construct the angle bisector of QPR . [1]
- (d)** The point X is equidistant away from P and Q , nearer to PQ than PR . Mark and label a possible placement of X . [1]

Marking Scheme

Qn	Solution
1a	3.95847
1b	3.958
2	$\frac{10x^2 - 23xy - 99y^2}{2x^2y - 9xy^2}$ $= \frac{(5x + 11y)(2x - 9y)}{xy(2x - 9y)}$ $= \frac{5x + 11y}{xy}$
3	$5^x + 6(7^x)^0 = 31$ $5^x = 25$ $x = 2$
4	$40000 = P \left(1 + \frac{2.2}{100} \right)^{3 \times 2}$ $P = 37458.73$ $= 37459$
5	$\sin\left(\frac{1}{2}x^\circ\right) = 0.123$ $\frac{1}{2}x = 7.06 \text{ or } 172.94$ $x = 14.1 \text{ or } 345.9$
6	$n = -1$ $c = 2$
7a	$x^2 + 4x - 10 = (x + 2)^2 - 14$

7b	
8	His answer is when the FIRST pen is red and SECOND pen is black. $\left(\frac{10}{16}\right)\left(\frac{6}{15}\right) + \left(\frac{6}{16}\right)\left(\frac{10}{15}\right) = \frac{1}{2}$
9a	72×45 $= (2^3 \times 3^2) \times (3^2 \times 5)$ $= 2^3 \times 3^4 \times 5$ $\frac{p}{q} = \frac{2}{5}$ $p = 2$ $q = 5$
9b	12
10	In triangle ABC and triangle ARP, Angle A is common. Angle $ABC = \text{Angle } ARP = 90^\circ$ (given) $AB = 5 - 2 = 3 \text{ cm} = AR$ Therefore triangle $ABC \equiv \text{triangle } ARP$ (AAS)

11	$\left(\frac{l_1}{l_2}\right)^3 = \frac{1404}{3328}$ $\left(\frac{l_1}{l_2}\right)^3 = \frac{27}{64}$ $\frac{l_1}{l_2} = \frac{3}{4}$ $\frac{A_1}{1008} = \left(\frac{3}{4}\right)^2$ $A_1 = 567$
12	$c + m = 168 \text{-----(1)}$ $4c + 2m = 592 \text{-----(2)}$ $(1) \times 2:$ $2c + 2m = 336 \text{-----(3)}$ $(2) - (3):$ $2c = 256$ $c = 128$
13a	6.55
13b	$b = \sqrt{\frac{5c + 2a}{3a}}$ $b^2 = \frac{5c + 2a}{3a}$ $3ab^2 = 5c + 2a$ $3ab^2 - 2a = 5c$ $a(3b^2 - 2) = 5c$ $a = \frac{5c}{3b^2 - 2}$
14a	3.75×10^6
14b	1.92×10^4
15ai	$A = \{13, 15, 17, 19\}$ $B = \{12, 15, 18\}$
15aaii	2

15b	
16a	$x^2 - 6xy + 9y^2 - 16$ $= (x - 3y)^2 - 4^2$ $= (x - 3y - 4)(x - 3y + 4)$
16b	$4pq + 3r - 6qr - 2p$ $= 4pq - 2p - 6qr + 3r$ $= 2p(2q - 1) - 3r(2q - 1)$ $= (2q - 1)(2p - 3r)$
17a	0.8
17b	12
17c	$1\text{cm}^2 : 0.64\text{km}^2$ $\frac{1}{0.64} \times 10$ $= 15.625$
18a	$y = kX^{\frac{1}{3}}$ $y = k\left(\frac{1}{8}X\right)^{\frac{1}{3}}$ $y = \frac{1}{2}k(X)^{\frac{1}{3}}$ $y = \frac{1}{2} \times 50$ $= 25$
18b	$0.8l \times 1.2b = 0.96lb$ $\frac{0.96lb - lb}{lb} \times 100\%$ $= -4\%$ Incorrect because the area decreased

19	$\text{Jude} : \frac{5}{6} \text{ parcels / hr}$ $\text{Alyssa} : \frac{4}{5} \text{ parcels / hr}$ $\text{Combined} : \frac{5}{6} + \frac{4}{5} = \frac{49}{30} \text{ parcels / hr}$ $15 \div \frac{49}{30} = 9.1837 \text{ hr}$ $= 9 \text{ h } 11 \text{ min}$
20a	$\tan AOB = \frac{14}{6}$ $AOB = 1.1659$ $= 1.17$
20b	6×1.1659 $= 6.9954$ $OC = \sqrt{6^2 + 14^2}$ $= 15.232$ $\text{Perimeter} = 6.9954 + (15.232 - 6) + 14$ $= 30.2$
21a	$I = \frac{84150 \times 2.8 \times 7}{100}$ $= 16493.40$
21b	$\frac{16493.40 + 84150}{7 \times 12}$ $= 1198.14$
22ai	$\overrightarrow{BC} + \overrightarrow{CD}$ $= 3m + n$
22aii	$\overrightarrow{PC} + \overrightarrow{CA}$ $= 2m + 2n$

22b	$\overrightarrow{BP} + \overrightarrow{PQ}$ $= m + \frac{1}{4}\overrightarrow{PA}$ $= m + \frac{1}{4}(2m + 2n)$ $= \frac{3}{2}m + \frac{1}{2}n$
22c	Since $\overrightarrow{BQ} = \frac{1}{2}\overrightarrow{BD}$ B is a common point
22d	$\frac{3}{4}$
23a	9
23b	10 or 11
24ai	$\frac{v}{20} = 1.5$ $v = 30$
24aaii	$\frac{1}{2}(T - 20 + 80)(30) = 1650$ $15(T + 60) = 1650$ $T = 50$
24b	The bus is travelling at a constant speed of 30 m/s
25a	$V = \pi(5x)^2 y + \frac{2}{3}\pi(4x)^3$ $= 25\pi x^2 y + \frac{128}{3}\pi x^3$
25b	$2700\pi = 25\pi(1.5)^2 y + \frac{128}{3}\pi(1.5)^3$ $56.25y = 2556$ $y = 45.44$
25c	$2\pi(6)^2 + 2\pi(7.5)(45.44) + \pi(7.5)^2$ $+ [\pi(7.5)^2 - \pi(6)^2]$ $= 2607.84\text{cm}^2$

	2607.84×0.002 $= \$5.22$
26a	Construction 26 A plot of land is in the shape of a quadrilateral $PQRS$, such that $QR = 8$ cm, angle $PQR = 81^\circ$ and $PS = RS = 9.8$ cm. PQ has been drawn for you. (a) Construct the quadrilateral. [2] (b) Construct the perpendicular bisector of PQ. [1] (c) Construct the angle bisector of QPR. [1] (d) The point X is equidistant away from P and Q, nearer to PQ than PS. Mark and label a possible placement of X. [1]