Class/ Index Number	Centre Number/ 'O' Level Index Number	Name
/	/	

新加坡海星中学

MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

MATHEMATICS **4052/1**
Paper 1
18 August 2025

Candidates answer on the Question Paper. **2 hours 15 minutes**

READ THESE INSTRUCTIONS FIRST

Write your class, index number 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** 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 with the answer.
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		
Subtotal		90
Statement		
Presentation		
Units		
Rounding off		

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Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone $= \pi rl$

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

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1 Simplify $x^3 - x(x+2)(x-2)$.

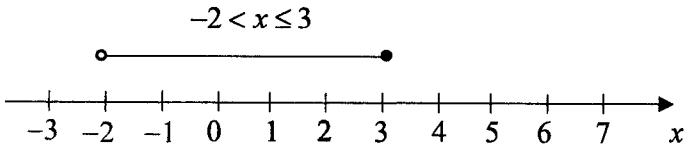
$x^3 - x(x+2)(x-2)$
$= x^3 - x(x^2 - 4)$
$= x^3 - x^3 + 4x$
$= 4x$

Markers Report
Well done but a few expanded wrongly

Answer ..... [2]

2 Represent the solution set of the simultaneous inequalities $x \leq 3$ and $-2 < x < 6$ on the number line below.

Answer



[1]

Markers Report
Well done but some did not draw final number line (shading alone not accepted)

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3 The cash price for a car was \$150000.
Sally paid a downpayment of \$90000 and paid the remaining amount by monthly instalments for 5 years.
A simple interest of x% per annum was charged and that her monthly instalment was \$1090.

(a) Find the value of x.

$150000 - 90000 = 60000$

$1090 \times 5 \times 12 = 65400$

$\text{Interest} = 65400 - 60000$

$= 5400$

$5400 = \dfrac{60000(x)(5)}{100}$

$x = 1.8$

Markers Report
A handle used percentage change formula resulting in 9% (wrong concept)

Answer $x =$ ..... [4]

(b) Calculate the extra cost of using hire purchase as a percentage of the cash price.

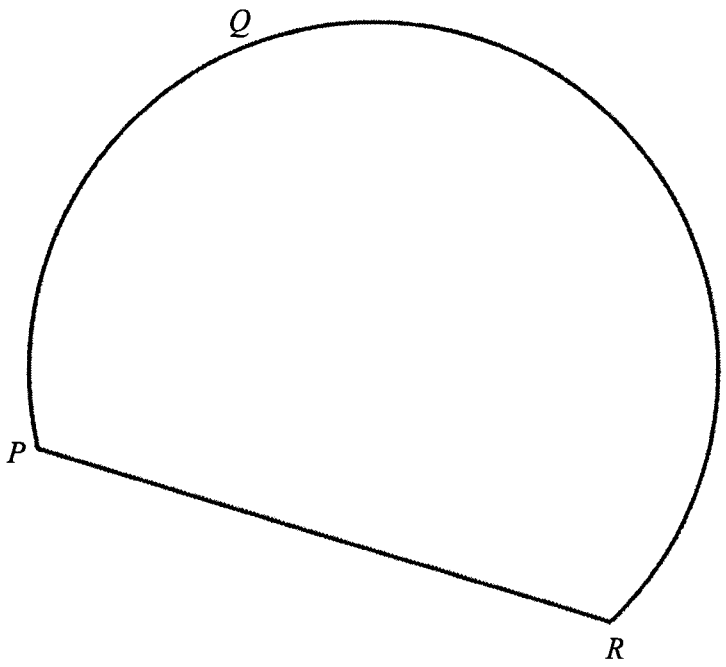
$\dfrac{5400}{150000} \times 100\% = 3.6\%$

Answer ..... % [1]

Markers Report
Generally well done

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4 The diagram shows a segment of a circle, PQR.



(a) A point X on the perimeter of the segment is such that $PX = RX$.
Find and label the position of X. [1]

(b) On the diagram, construct the angle bisector of angle XPR. [1]

(c) On the diagram, shade a region inside PQR that is closer to PR than PX, and closer to P than R. [1]

Markers Report
Generally well done but some students have missing arcs.

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5 **(a)** An interior angle of a regular n-sided polygon is 1.5 times larger than its exterior angle. Find n.

$x + 1.5x = 180°$

$2.5x = 180°$

$x = 72°$

Markers Report
Generally well done, other methods accepted.

$n = \frac{360°}{72°}$

$n = 5$

Answer $n =$ ..... [3]

(b) What is the name of the n-sided polygon given in part (a) ?

Pentagon

Markers Report
Generally well done.

Answer ..... [1]

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6 The scale of Map *A* is given as 1: 200 000.

(a) The length of a road on the map is 6 cm.

Calculate the actual distance, in kilometres, of the road.

1: 200000
1 cm: 2 km
6 cm: 12 km

Markers Report
Generally well done.

Answer ..... km [2]

(b) The scale of Map *B* is 1: 250 000 and the size of an island on Map *B* is $3.6\,cm^2$.

Calculate the area of the same island, in square centimetres, on Map *A*.

$1:250000$
$1\,cm:2.5\,km$
$1\,cm^2:6.25\,km^2$
3.6×6.25
$=22.5\,km^2$

Markers Report
Generally well done.

$1\,cm^2:4km^2$
$\frac{22.5}{4}=5.625\,cm^2$

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

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7 Factorise

(a) $2+5x-3x^2$,

$2+5x-3x^2$
$=(3x+1)(-x+2)$

Markers Report
Generally well done, accept other forms eg.
$-(3x+1)(x-2)$, $(-3x-1)(x-2)$

Answer ..... [2]

(b) $3x^2-24y+4x-18xy$.

$3x^2-24y+4x-18xy$
$=x(3x+4)-6y(4+3x)$
$=(x-6y)(3x+4)$

Markers Report
Generally well done

Answer ..... [2]

8 The first four terms in a sequence are 2, 6, 18, 54.

(a) Find an expression, in terms of n, for the nth term of the sequence.

$2(3)^{n-1}$

Markers Report
Not well done, many cannot deduce the general term. Accept other simplified expressions.

Answer ..... [1]

(b) Explain why the number 98415 is not a term of the sequence.

Because the number if not even.

.....

..... [1]

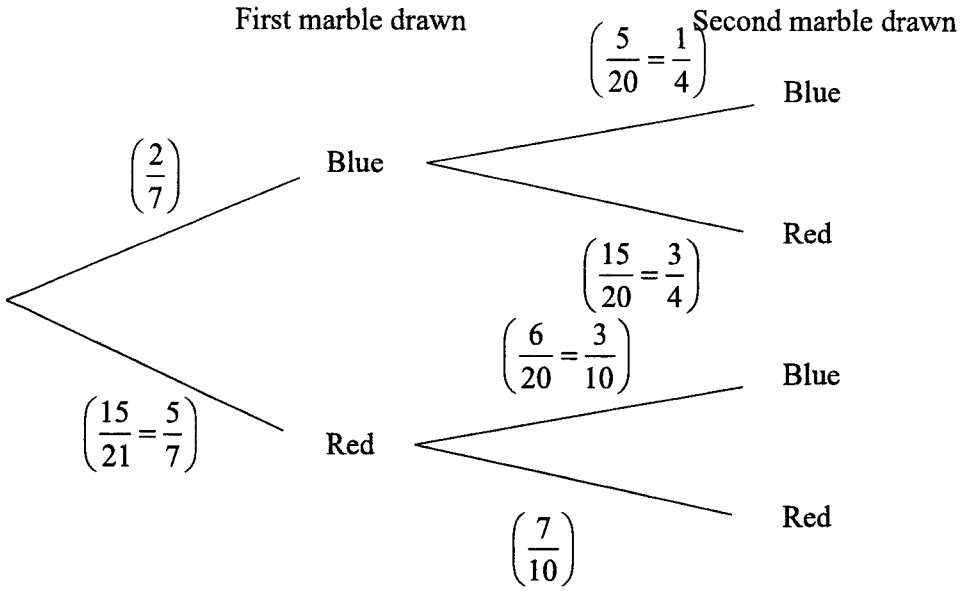
Markers Report
Not well done. Accept actual finding of n and explain that n is not whole number.
No ecf if n is found from wrong expression in part (a).

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9 A bag contains 21 marbles, of which 6 are blue and 15 are red.

Two marbles are drawn at random, one after the other, from the box without replacement.

(a) Complete the tree diagram below. [2]



Markers Report

- In general, well done
- Students forget to reduce fractions

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(b) Find the probability that

(i) both marbles drawn are blue.

$$\frac{2}{7}\times\frac{1}{4}=\frac{1}{14}$$

Answer ..... [1]

(ii) at most one of the marbles drawn is red.

$$1-\left(\frac{5}{7}\times\frac{7}{10}\right)$$
$$=\frac{1}{2}$$
or
$$\left(\frac{5}{7}\times\frac{3}{10}\right)+\left(\frac{2}{7}\times\frac{3}{4}\right)+\left(\frac{2}{7}\times\frac{1}{4}\right)$$
$$=\frac{1}{2}$$

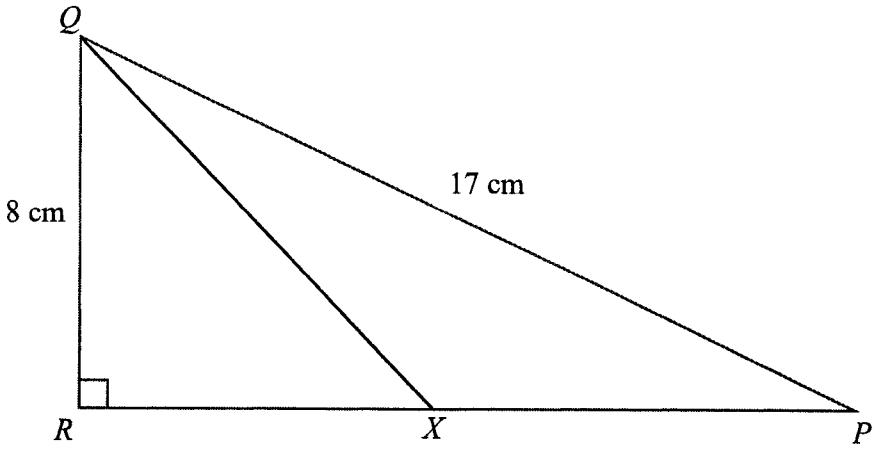
Answer ..... [2]

Markers Report
- (b)(i) In general, well done
- (b) (ii) Students did not interpret correctly and included the case where both are red.

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10 In the diagram, PXR is a straight line,

$\angle PRQ = 90°, PQ = 17$ cm, $QR = 8$ cm and area of $\Delta PXQ = 36$ cm^2.



Calculate

(a) RX,

$\frac{1}{2}(PX)(8) = 36$

$PX = 9$

Markers Report
Well done

$RP = \sqrt{17^2 - 8^2}$

$RP = 15$

$RX = 15 - 9$

$RX = 6\,\text{cm}$

Answer ..... cm [3]

(b) $\cos \angle QXP$.

$\cos \angle QXP = -\frac{6}{\sqrt{8^2 + 6^2}}$

$= -\frac{6}{10}$

$= -\frac{3}{5}$

Markers Report
Many omitted the negative sign

Answer ..... [2]

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11 **(a)** 6 workers can paint a building in 44 days.

Find the additional number of workers needed if the building is to be painted in 11 days.

6 Workers : 44 days
6×4 workers : 11 days
Additional workers
$= 24 - 6$
$= 18$

Markers Report
The question ask for additional workers. There is a need to subtract from the original number.

Answer ..... workers [3]

(b) A is inversely proportional to B^2.

If B increases by 20%, find the percentage decrease in A.

$$A = \frac{k}{B^2}$$
$$k = AB^2$$
$$B_{new} = 1.2B$$
$$A_{new} = \frac{AB^2}{(1.2B)^2}$$
$$A_{new} = \frac{25}{36}A$$

Markers Report
Badly done
←No marks awarded at this point
Students need to show correct method of percentage decrease.

Percentage decrease

$$\frac{A - \frac{25}{36}A}{A} \times 100\%$$
$$= 30\frac{5}{9}\%$$

Answer ..... % [2]

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12 It is given that $a = \dfrac{b+2cd}{b-cd}$.

(a) Evaluate a when $b = -8$, $c = 0.873$ and $d = -2$.
Give your answer correct to **2 significant figures.**

$$a = \frac{-8+2(0.873)(-2)}{-8-(0.873)(-2)}$$
$$a = 1.83754$$
$$a = 1.8 (2sf)$$

Markers Report
Well done but still a few not rounding off to 2 sf

Answer $a =$ ..... [2]

(b) Express b in terms of a, c and d.

$$a = \frac{b+2cd}{b-cd}$$
$$a(b-cd) = b+2cd$$
$$ab - acd = b+2cd$$
$$ab - b = 2cd + acd$$
$$b(a-1) = cd(2+a)$$
$$b = \frac{cd(2+a)}{a-1}$$

Markers Report
Well done. Variations of answers were accepted.

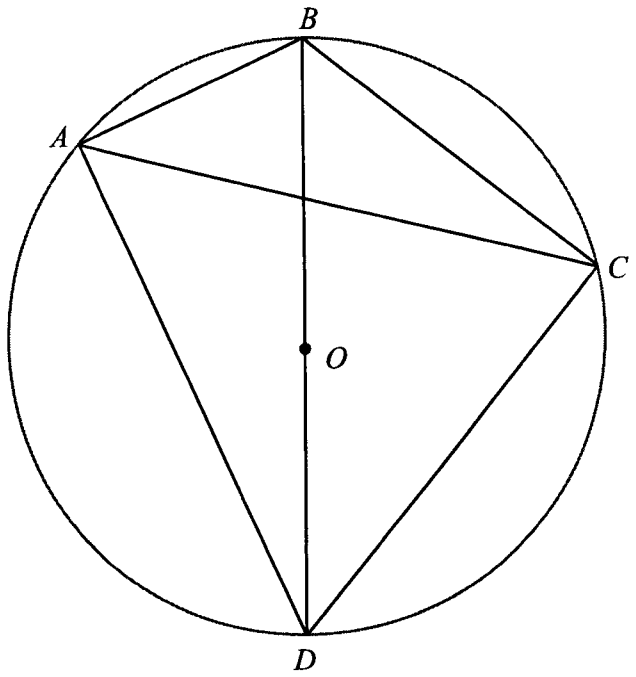
Answer $b =$ ..... [2]

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13 The diagram shows four points A, B, C and D which lie on the circumference of a circle with centre O..

BD is the diameter of the circle.

Angle $BDC = 30°$ and angle $BCA = 20°$.



Find, giving reasons for each answer,

Markers Report
It was noted that a lot of students do not memorize the correct angle property.

(a) angle ABD,

$\angle BAD = 90°$ (rt angle in semi-circle)
$\angle BDA = 20°$ (angles in same segment)
$\angle ABD = 180° - 90° - 20°$ (angle sum of triangle)
$= 70°$

Answer Angle ABD ..... [3]

(b) angle ABC.

$\angle ABC = 180° - 30° - 20°$ (angles in opposite segment)
$= 130°$

Markers Report
All other methods also accepted.

Answer Angle ABC = ... [2]

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14 Solve these simultaneous equations.

$$3y+\frac{1}{2}=15x$$
$$3x-2y=5$$

You must show your working.

$3y=15x-\frac{1}{2}$

$y=5x-\frac{1}{6}$

Subt into $3x-2y=5$

$3x-2\left(5x-\frac{1}{6}\right)=5$

$3x-10x-\frac{1}{3}=5$

$-7x=4\frac{2}{3}$

$x=-\frac{2}{3}$

$y=5\left(-\frac{2}{3}\right)-\frac{1}{6}$

$y=-3.5$

Markers Report
It was noted that students who did elimination method often make careless mistakes.
Other than that, well done.

Answer x = ...

y = ... [3]

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15 Bank A pays a compound interest of 2% per annum compounded half-yearly.
Matthew will be making a deposit of $10 000.

Calculate how much interest Matthew will earn after 3 years.

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

$$A = 10000\left(1+\frac{\frac{2}{2}}{100}\right)^6 - 10000$$

$$= 10615.20151 - 10000$$

$$= \$615.20$$

Markers Report
Many left r as 2 instead of 2/2

Also the question is asking for interest. Student forget to subtract to find the difference.

Answer $..... [3]

16

$\varepsilon = \{x : x \text{ is an integer and } 0 < x < 11\}$

$A = \{x : x \text{ is a factor of } 20\}$

$B = \{x : x \text{ is a prime number}\}$

(a) List the elements of

(i) A,

$\{1,2,4,5,10\}$

Answer = ... [1]

(ii) $A \cup B$.

$B = \{2,3,5,7\}$

$A \cup B = \{1,2,3,4,5,7,10\}$

Markers Report
Well done for (i)
Many did not include number 10 for (aii)
(b) many gave answers is the elements 3 and 7

Answer = ... [1]

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

$A' = \{3, 6, 7, 8, 9\}$

$A' \cap B = \{3, 7\}$

$n(A' \cap B) = 2$

Answer ..... [2]

17 **(a)** Write 2574 in standard form.

2.574×10^3

Markers Report
don't round off to 2.57. it is exact.

Answer ..... [1]

(b) Find the difference between 3.7×10^{105} and 4.6×10^{106}.
Give your answer in standard form.

$4.6 \times 10^{106} - 3.7 \times 10^{105}$

$= 46 \times 10^{105} - 3.7 \times 10^{105}$

$= (46 - 3.7) \times 10^{105}$

$= 42.3 \times 10^{105}$

$= 4.23 \times 10^{106}$

Markers Report
Many gave answer as 4.23

Answer ..... [1]

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18 Written as a product of prime factors,

$$588 = 2^2 \times 3 \times 7^2 \text{ and } 1400 = 2^3 \times 5^2 \times 7 .$$

Find

(a) the smallest integer, m, such that $1400m$ is a perfect cube.

$1400m$
$= 2^3 \times 5^2 \times 7 \times m$
$m = 5 \times 7^2$
$m = 245$

Markers Report
Answer should be given as an integer and not in factor form,

Answer $m =$ ..... [1]

(b) the greatest integer that will divide both 1400 and 588 exactly.

$HCF = 2^2 \times 7$
$HCF = 28$

Markers Report
Well done

Answer ..... [1]

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19 For the month of January, the amount of money, in dollar, saved individually by 13 students are shown below.

January 58, 43, 64, 68, 60, 92, 79, 94, 88, 67, 80, 41, 24
(in dollars)

The amount of money, in dollars, saved by the same students in the month of February are summarized below.

February

Mean amount of savings	\$62.50
Standard Deviation	\$18.20

(a) Find

(i) the mean savings of the 13 students for the month of January,

$\frac{858}{13}$
$= 66$

Markers Report
Well done

Answer \$..... [1]

(ii) the standard deviation of the savings in January.

$\sqrt{\frac{61964}{13} - \left(\frac{858}{13}\right)^2}$
$= 20.26$

Markers Report
Students should show the value they substitute into the formula

Answer \$..... [2]

(b) The amount of money, in dollar, saved by the same group of students were calculated again in March 2024 as shown below.

March 58, 43, 64, 68, 60, 92, 79, 94, 88, 67, 80, 41, **10**
(in dollars)

Given that only the lowest amount saved by a student in March was changed to \$10. State how the mean and standard deviation will change in March 2024 as compared January 2024.

Markers Report
Generall Well done

The Mean will be lower but the standard deviation will increase.

..... [2]

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20 The base and the height of a triangle are each reduced by 40% followed by an increase of 50%. Find the percentage reduction of the area of the final triangle compared to the original triangle.

$\frac{1}{2}(0.6b \times 1.5)(0.6h \times 1.5)$

$= \frac{1}{2}\left(\frac{81}{100}\right)bh$

Reduction

$= 1 - \frac{81}{100}$

$= \frac{19}{100}$

Percentage reduction

$= \frac{19}{100} \times 100\%$

$= 19\%$

Markers Report
Badly done. Students interpret it as the base reduce by 40% and the height by 50% however questions says clearly it is for each base and height.

Answer ..... % [3]

21 Solve the equation $\frac{x}{4} - \frac{3x-2}{5} = -1$.

$\frac{x}{4} - \frac{3x-2}{5} = -1$

$5x - 12x + 8 = -20$

$-7x = -28$

$x = 4$

Markers Report
Well done except for some careless mistake of -8 instead of +8

Answer x = ... [3]

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22 **(a)** Solve the equation $x^2 - \frac{3}{4}x - 5 = 0$ by completing the square.

Give your solutions correct to 2 decimal places.

$x^2 - \frac{3}{4}x - 5 = 0$

$x^2 - \frac{3}{4}x + \left(\frac{3}{8}\right)^2 = 5 + \left(\frac{3}{8}\right)^2$

$\left(x - \frac{3}{8}\right)^2 = \frac{329}{64}$

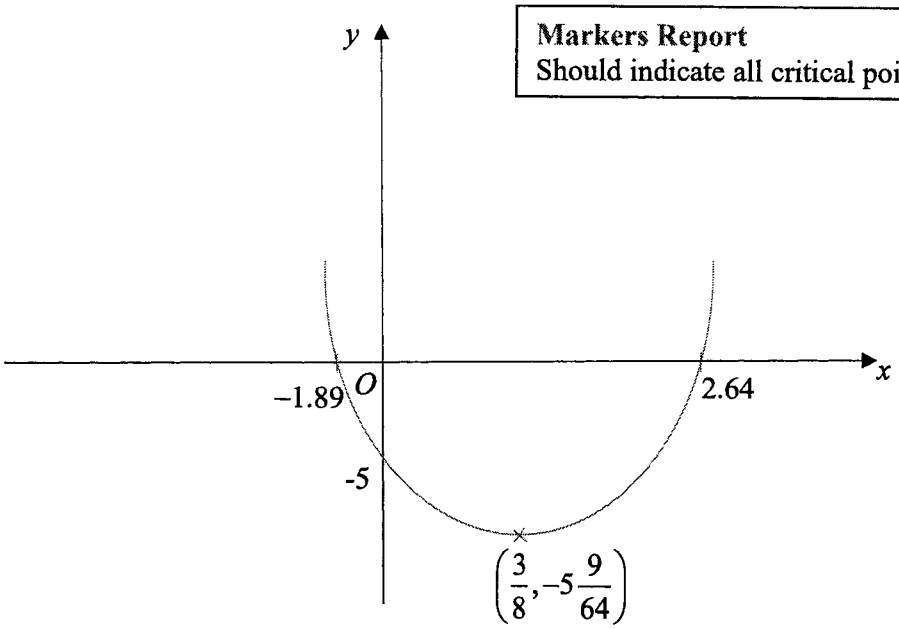
$x = \pm\sqrt{\frac{329}{64}} + \frac{3}{8}$

$x = 2.64$ *or* $x = -1.89$

Markers Report
No marks for using quadratic formula

Answer ..... [3]

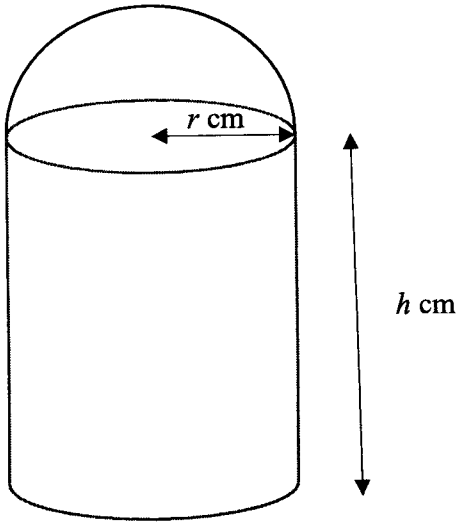
(b) Hence, sketch the graph of $y = x^2 - \frac{3}{4}x - 5$, indicating all intercepts and turning point(s) clearly. [2]



Markers Report
Should indicate all critical points

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23 A hollow container is made by joining a hemisphere of radius r cm to an open cylinder of radius r cm and height h cm.



(a) If the ratio of the capacity of the hemisphere to the capacity of the cylinder is 1 : 4, show that $h = \frac{8}{3}r$.

Answer

$$\frac{\frac{2}{3}\pi r^3}{\pi r^2 h} = \frac{1}{4}$$

$$\frac{\frac{2}{3}\pi r}{h} = \frac{1}{4}$$

$$\frac{2}{3}r = \frac{1}{4}h$$

$$h = \frac{8r}{3} (shown)$$

Markers Report
Well done

[2]

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(b) If the total capacity of the container is $\frac{80\pi}{3}$ cm^3, find the radius.

$\frac{2}{3}\pi r^3 + \pi r^2 h = \frac{80\pi}{3}$

$\frac{2}{3}\pi r^3 + \pi r^2\left(\frac{8r}{3}\right) = \frac{80\pi}{3}$

$2r^3 + 8r^3 = 80$

$10r^3 = 80$

$r^3 = 8$

$r = 2$

Markers Report
Generally well done though some used area instead.

Answer ..... cm [2]

(c) Find the area of the metal sheet used to make the container.
Leave your answer in terms of π.

$2\pi r^2 + 2\pi rh$

Subt $r = 2$

$2\pi(2)^2 + 2\pi(2)h$

$= 8\pi + \frac{16}{3}\pi(4)$

$= 29\frac{1}{3}\pi$

Markers Report
Answer must be exact.

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

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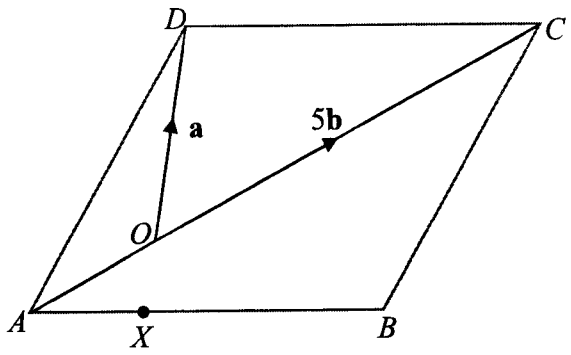
24 **The diagram is not drawn to scale.**

$\overrightarrow{AC} = 6\overrightarrow{AO}$ and $AX : XB = 1 : 4$.

$ABCD$ is a parallelogram.

AOC is the diagonal of the parallelogram.

The position vectors of C and D, relative to O are $5\mathbf{b}$ and $\mathbf{a}$ respectively.



(a) Express each of the following in terms of **a** and **b**.

(i) $\overrightarrow{AD}$,

Markers Report
Students must underline vectors

$\overrightarrow{AO} + \overrightarrow{OD}$

$= \underset{\sim}{b} + \underset{\sim}{a}$

Answer ..... [1]

(ii) $\overrightarrow{AX}$,

$\overrightarrow{AX}$

$= \frac{1}{5}\overrightarrow{DC}$

$= \frac{1}{5}\left(\overrightarrow{DO} + \overrightarrow{OC}\right)$

$= \frac{1}{5}\left(-\underset{\sim}{a} + 5\underset{\sim}{b}\right)$

Markers Report
Badly done, a lot assume AC is 5b

Answer ..... [2]

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(iii) position vector of X.

,

$$\overrightarrow{AX} = \overrightarrow{OX} - \overrightarrow{OA}$$

$$-\frac{1}{5}\underset{\sim}{a} + \underset{\sim}{b} = \overrightarrow{OX} - (-\underset{\sim}{b})$$

$$\overrightarrow{OX} = -\frac{1}{5}\underset{\sim}{a}$$

Markers Report
Many do not know what the question is asking for. Some gave answers in column vector which is wrong.

Answer ..... [2]

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End of Paper

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