

MINISTRY OF EDUCATION, SINGAPORE in collaboration with CAMBRIDGE ASSESSMENT INTERNATIONAL EDUCATION General Certificate of Education Ordinary Level

CANDIDATE			
NAME			



CENTRE NUMBER

INDEX NUMBER

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	.050	

MATHEMATICS

Paper 1

4052/01

October/November 2024 2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, 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. DO NOT WRITE ON ANY BARCODES.

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.

Singapore Examinations and Assessment Board

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DC (CJ/CT) 330027/6

This document consists of 19 printed pages and 1 blank page.

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Mathematical Formulae

Compound interest

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

Statistics

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

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

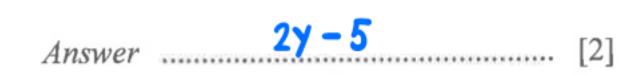
Mean =
$$\frac{\sum fx}{\sum f}$$

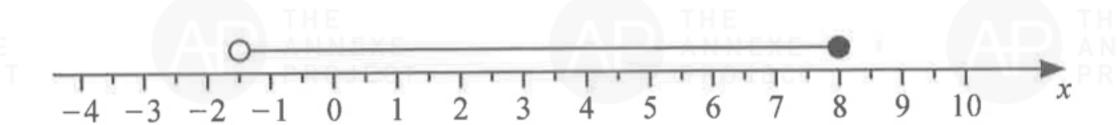
Standard deviation =
$$\sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$



Simplify
$$3y-7-5y+4+4y-2$$
.
 $3y-5y+4y-7+4-2$
 $= 2y-5$

Answer all the questions.





Write down the inequality that represents the numbers indicated on the number line.

$$-\frac{3}{2} < x \leq 8$$
Answer \(-\frac{3}{2} < x \leq 8 \)

- The cash price of a garden fountain is \$2250. 3 Arman buys the fountain using hire purchase. She pays a deposit of 18% of the cash price plus 24 equal monthly payments of \$92.75.
 - (a) Calculate the total amount that Arman pays for the fountain.

$$(0.18 \times 2250) + (24 \times 92.75) = $2631$$

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

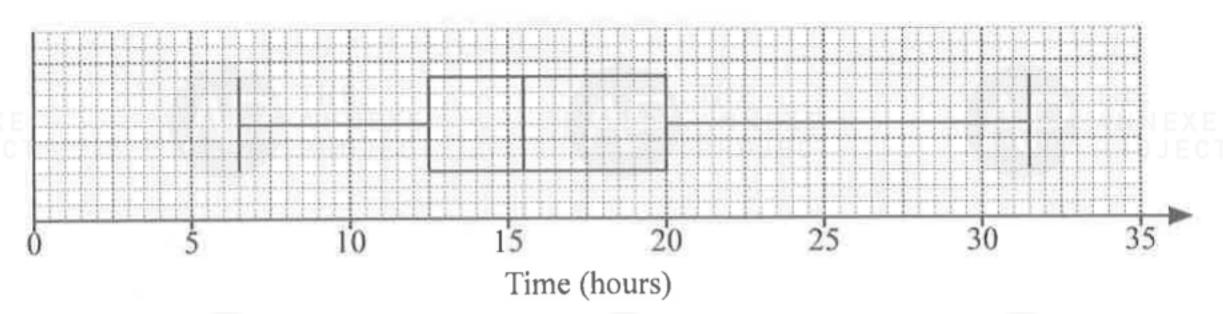
$$\frac{2631-2250}{2250} \times 100\% = 16.933$$

= 16.9%



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The box-and-whisker plot gives information about the times, in hours, that 120 adults spent on social media in one week.

(a) Use the box-and-whisker plot to find the median time.

Rishi says, "There are almost twice as many adults who spent more than 20 hours on social media as there are adults who spent less than 12.5 hours".

Is he correct? Give a reason for your answer.

Rishi is incorrect. 20 h is the upper quartile time while 12.5h is the lower quartile time. Hence, there is equal number of adults who spent more than 20h on social media as there are adults who spent less than 12.5 h.

Express as a single fraction in its simplest form $\frac{7x}{6} - \frac{3(x+1)}{8} - \frac{7x-6}{24}$.

$$\frac{28x}{24} - \frac{9(x+1)}{24} - \frac{7x-6}{24}$$

$$= \frac{28x-9x-9x-9-1x+6}{24}$$

$$= \frac{12x-3}{24}$$

$$= \frac{4x-1}{8}$$







- A map of Singapore has a scale of 1: 200000.
 - The scale can be written in the form 1 cm : n km.

Find the value of n.

$$200000 cm = 2000m = 2 km$$

Answer
$$n = \dots 2$$
 [1]

The distance on the map from Changi Airport to Bukit Panjang is 18.9 cm.

Calculate the actual distance, in kilometres, between these two places.

$$18.9 \times 2 = 37.8$$

The area of Singapore is 728.6 km².

Calculate the area, in square centimetres, of Singapore on the map.

$$728.6 \div 4 = 182.15$$

- Factorise.
 - (a) 18a 24b + 15c

$$= 3(6a - 8b + 5c)$$

$$3(6a - 8b + 5c)$$
Answer [1]

(b)
$$3 + 2m^2xy - 2my - 3mx$$

$$= 3 - 3mx + 2m^2xy - 2my$$

$$= 3(1-mx) + 2my(mx-1)$$

$$= 3(1-mx) - 2my(1-mx)$$

$$= (3-2my)(1-mx)$$





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

The sum of the first five terms is 105.

Find the values of w, x, y and z.



$$W + (W+a) + (W+2a) + (W+3a) + (W+4a) = 105$$

$$5W + 10a = 105$$

W + 2a = 21 —1

$$w + a = 15$$

 $a = 15 - W - 2$

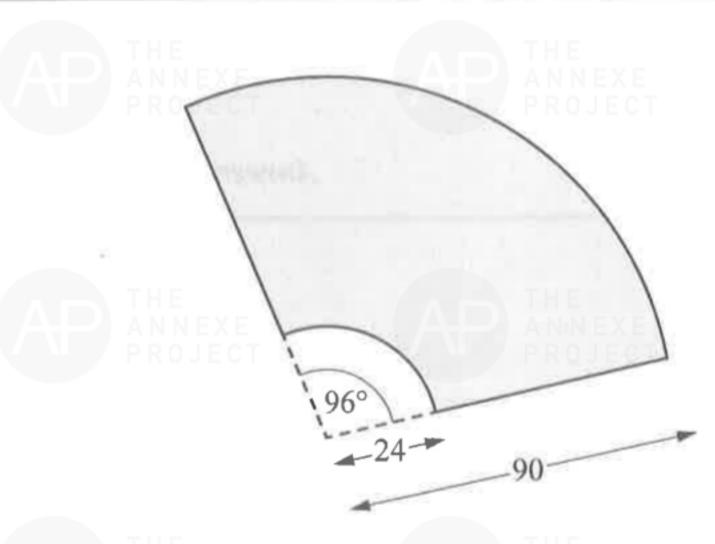
Sub 2 into 1:
$$W + 2(15-W) = 21$$

$$1 + 2(15 - W) = 21$$

$$W = 9$$

$$: a = 6$$

Answer
$$w = \frac{9}{x} = \frac{21}{x} = \frac{27}{z} = \frac{33}{z}$$
 [2]



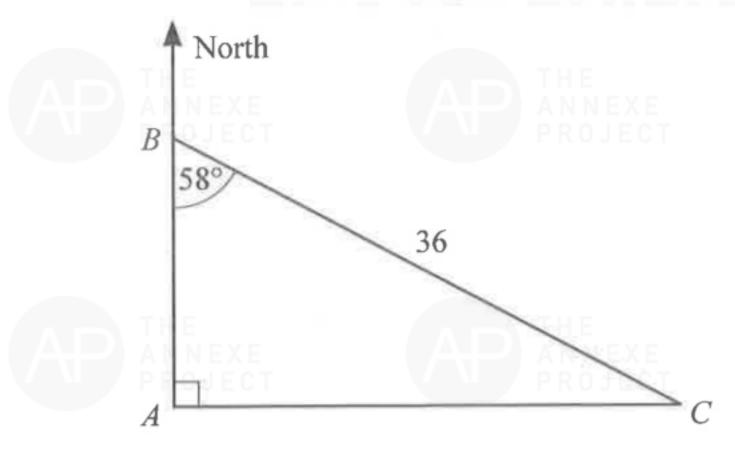
In the diagram, the shaded area represents the area cleaned by a windscreen wiper. All lengths are in centimetres.

Calculate the shaded area.

$$\left[\frac{96^{\circ}}{360^{\circ}} \times \pi(90^{2})\right] - \left[\frac{96^{\circ}}{360^{\circ}} \times \pi(24^{2})\right] = 6303 \cdot 29$$

$$= 6300 \text{ cm}^{2}$$

Answer $6300 \, \text{cm}^2$ [2]



A, B and C are three points on horizontal ground. Angle $ABC = 58^{\circ}$, angle $BAC = 90^{\circ}$ and $BC = 36 \,\mathrm{m}$.

(a) Calculate the distance AC.

$$\sin 58^\circ = \frac{AC}{36}$$

$$AC = 30.530 \\ = 30.5$$

(b) Calculate the perimeter of triangle ABC.

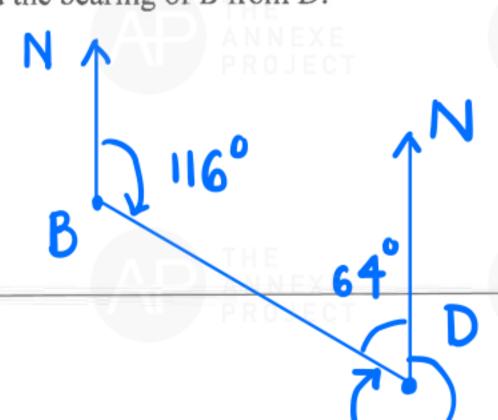
$$\cos 58^{\circ} = \frac{AB}{36}$$

$$AB = 19.077$$

Perimeter =
$$19.077 + 30.530 + 36 = 85.607$$

The point D is on a bearing of 116° from B.

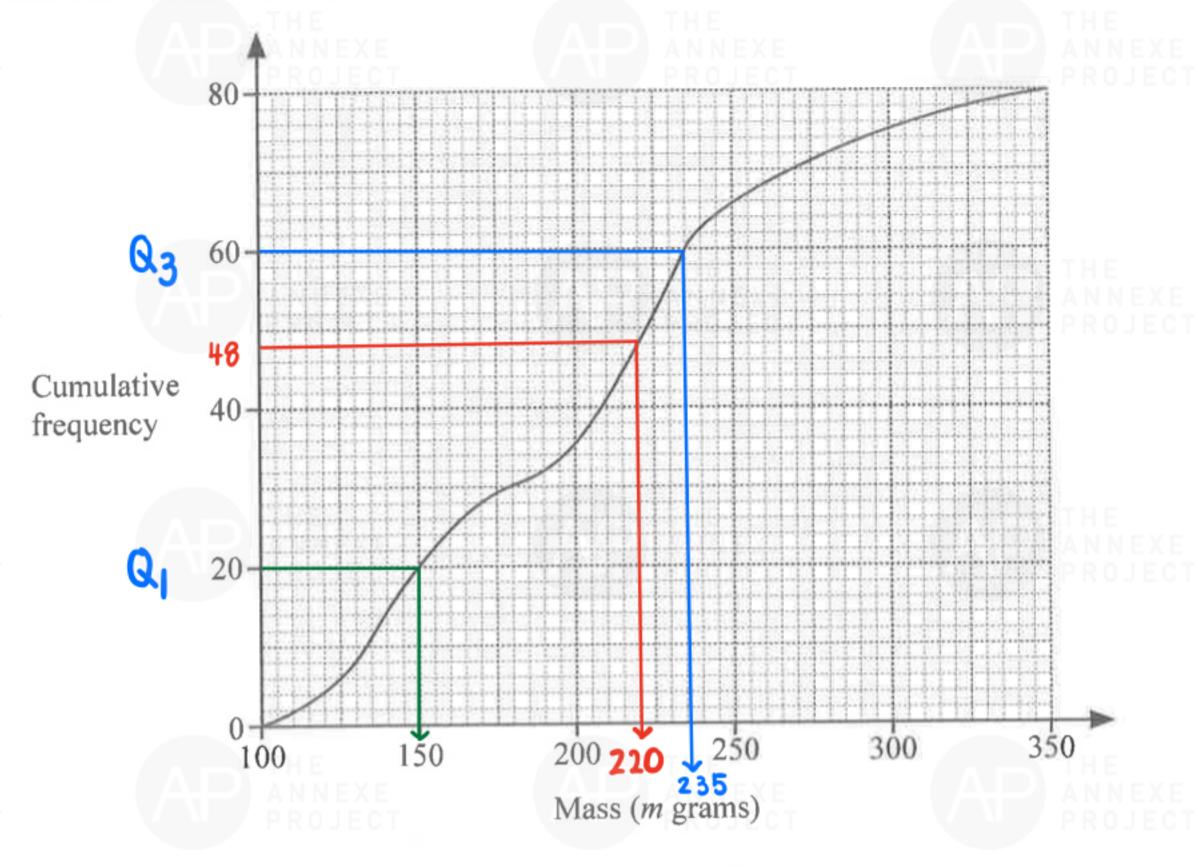
Find the bearing of B from D.



$$180^{\circ} - 116^{\circ} = 64^{\circ}$$

 $360^{\circ} - 64^{\circ} = 296^{\circ}$

A group of 80 people estimated the mass, m grams, of a potato. The cumulative frequency diagram represents their estimates.



(a) Use the diagram to find the interquartile range of the estimated masses.

Q3: Upper Quartile = 235 Q1: Lower Quartile = 150

$$Q_3 - Q_1 = 235 - 150$$

= 85

Answer g [2]

(b) One of these people is chosen at random. The probability that the person's estimate is greater than k grams is $\frac{2}{5}$.

Find the value of k.

$$\frac{2}{5}$$
 x 80 = 32 people estimated to be greater than K grams.
80 - 32 = 48

from diagram, k = 220g Answer









- $D = \frac{a}{b} bc^2$
 - (a) Find D when a = 98.31, b = 18.31 and c = 0.361. Give your answer correct to 2 significant figures.

$$D = \frac{98.31}{18.31} - (18.31)(0.361)^2 = 2.9830 = 3.0 (2s.f.)$$
Answer $D = 3.0$ [2]

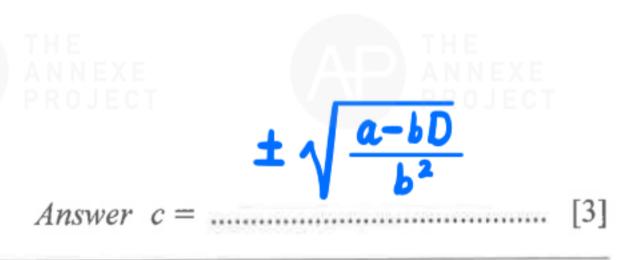
(b) Rearrange the formula to make c the subject.

$$bc^{2} = \frac{a}{b} - D$$

$$c^{2} = \frac{a}{b^{2}} - \frac{D}{b}$$

$$c^{2} = \frac{a - bD}{b^{2}}$$

$$c = \pm \sqrt{\frac{a - bD}{b^{2}}}$$



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A, B and C are points on a circle, centre O. ABD and AOC are straight lines, angle $CAB = 28^{\circ}$ and angle $BDC = 60^{\circ}$.

(a) Find angle *OBC*. Give a reason for each step of your working.

$$\angle OBA = 28^{\circ}$$
 (base $\angle s$ of isos. \triangle , $OA = OB$)
 $\angle CBA = 90^{\circ}$ (right angled \triangle in semi-circle)
 $\therefore \angle OBC = 90^{\circ} - 28^{\circ} = 62^{\circ}$

(b) Explain why DC is **not** a tangent to the circle.

$$\angle DCA = 180^{\circ} - 60^{\circ} - 28^{\circ} = 92^{\circ} \text{ (sum of } \angle s \text{ in } \triangle \text{ is } 180^{\circ}\text{)}$$

 $\therefore DC \text{ is not tangent to circle at } C.$

Solve these simultaneous equations.

$$6x + 5y = 2$$
 $10x - 4y = 65$

You must show your working.

$$1) \times 4: \quad 24x + 20y = 8$$

(2) x 5:
$$50x - 20y = 325 - 4$$

$$\frac{3 + 4}{x} = 333$$

$$\frac{x = 4.5}{x}$$

Sub
$$x = 4.5$$
 into 1: $6(4.5) + 5y = 2$

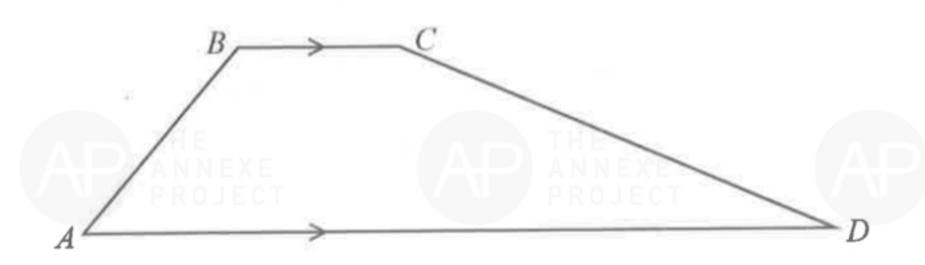
$$5y = 2 - 27$$

$$5y = -25$$

$$y = -5$$
Answer $x = 4.5$

$$y = -5$$
[3]

15



ABCD is a trapezium.

The ratio angle CBA: angle BAD: angle ADC = 9:3:2.

Find angle BCD.

12 units =
$$180^{\circ}$$
 (int. $\angle s$, $BC//AD$)

1 unit = 15°

Hence,
$$\angle ADC = 2 \times 15^{\circ} = 30^{\circ}$$

:
$$\angle BCD = 180^{\circ} - 30^{\circ} = 150^{\circ}$$
 (int. $\angle s$, $BC // AD$)

Answer Angle
$$BCD = 150^{\circ}$$
 [3]

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11

After 5 years, the money had earned total interest of \$2132.16.

Calculate the amount of money Alice invested in the account.

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

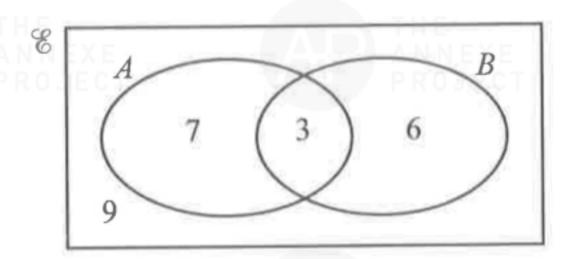
$$P + 2132 \cdot 16 = P(1 + \frac{3 \cdot 2}{100})^5$$

$$1.17057P - P = 2132.16$$

$$0 - 17057 P = 2132 - 16$$

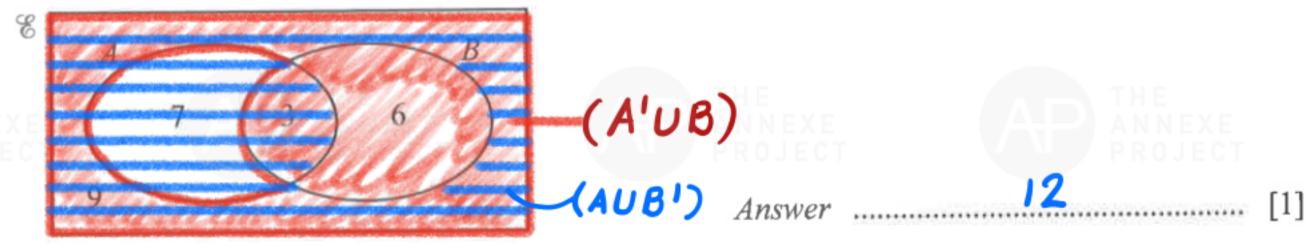
$$P = \frac{2132 \cdot 16}{0 \cdot 17057} = $12500 (nearest dollar)$$

17 The Venn diagram shows the universal set and the number of elements in each of its subsets.

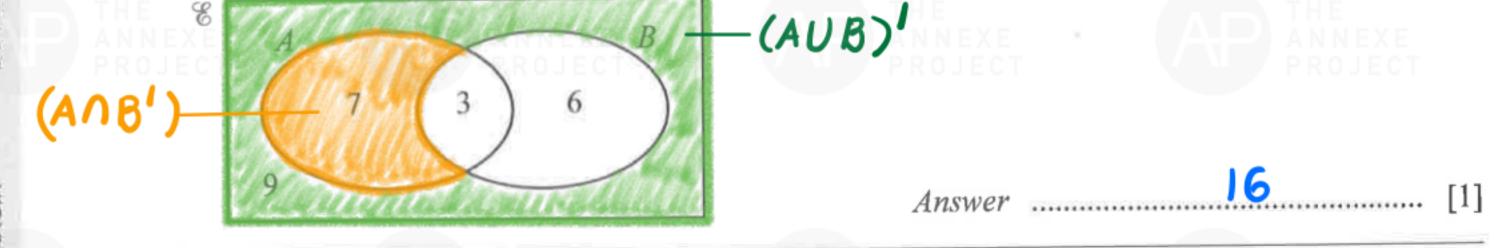


Find the value of

(a)
$$n((A' \cup B) \cap (A \cup B')) = 9 + 3 = 12$$

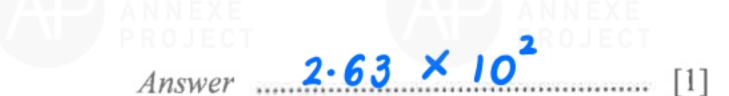


(b) $n((A \cap B') \cup (A \cup B)') = 9 + 7$



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18 (a) Write 263 in standard form.



(b) (i) Write 3.4×10^{99} in the form $A \times 10^{100}$.

$$\frac{3.4}{10} \times 10^{100}$$
$$= 0.34 \times 10^{100}$$

Answer
$$0.34 \times 10^{100}$$
 [1

(ii) Work out $(4.7 \times 10^{100}) + (3.4 \times 10^{99})$. Give your answer in standard form.

$$(4.7 \times 10^{100}) + (0.34 \times 10^{100})$$

= $(4.7 + 0.34) \times 10^{100}$
= 5.04×10^{100}

12

Answer
$$5.04 \times 10^{100}$$
 [1

Written as a product of its prime factors, $720 = 2^4 \times 3^2 \times 5$.

The highest common factor (HCF) of 720 and N is $2^4 \times 5$. The lowest common multiple (LCM) of 720 and N is $2^6 \times 3^2 \times 5^3$.

Find the value of
$$N$$
. $720 = 24 \times 3^2 \times 5 \times 5^2 \times 5^2$

$$HCF = 2^4 \times 5$$

 $\therefore N = 2^6 \times 5^3 = 8000 \text{ Answer } N = ... 8000$

$$\sin(2x^{\circ}) = 0.561$$

Find two possible values of x in the range $0 \le x \le 90$.

Step 1: Basic angle for
$$2x^{\circ} = \sin^{-1} 0.561$$

 $2x^{\circ} = 34.125^{\circ}$

Step 2:
$$2x^{\circ}$$
 lies in 1st quadrant or 2^{nd} quadrant.
 $2x^{\circ} = 34.125^{\circ}$ or $2x^{\circ} = 180^{\circ} - 34.125^{\circ}$
 $x = 17.1^{\circ}$ or 72.9°
Answer $x = 17.1^{\circ}$ or $x = 72.9^{\circ}$ [2]

The list shows information about the number of text messages Li received each day for 8 days.

The mean number of text messages per day is 17.5.

Show that p = 2.5.

 $(12+24+8+21+28+17)+2p+4p^2 = 17.5$

[3]

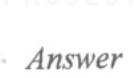
(b) The standard deviation for Li's data is 7.89.

For the same 8 days, Li's sister also received some text messages. For her data, the mean is 20 and the standard deviation is 9.51.

By commenting on (1.) the means and (2.) the standard deviations, compare the distributions for the number of text messages received by Li and his sister.

- 1. Li's sister receives more messages than Li during those 8 days as Li's sister's mean is higher.
- The number of text messages Li receives is more consistent than Li's sister, as Li's standard deviation is smaller.
- Expand $(2x-3)(3x^2+2x-5)$

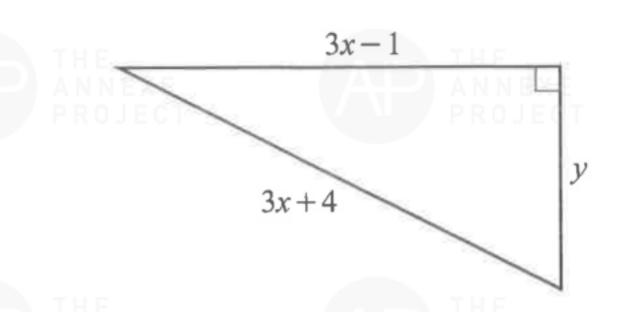
$$= 6x^{3} + 4x^{2} - 10x - 9x^{2} - 6x + 15$$
$$= 6x^{3} - 5x^{2} - 16x + 15$$



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[4]

23



14

The right-angled triangle has sides (3x-1), (3x+4) and y, where x and y are integers.

(a) Show that y is an odd number.

Answer

$$(3x-1)^{2} + y^{2} = (3x+4)^{2}$$

$$9x^{2} - 6x + 1 + y^{2} = 9x^{2} + 24x + 16$$

$$y^{2} = 30x + 15$$

$$y^{2} = 15(2x+1)$$

For any integers, 2x is always even and 2x+1 is always odd.

·· 15 (2x+1) is always odd.

Hence, y is always odd.

Since odd × odd is always odd, y is an odd number.



Important Concept:

(b) Find a possible value of y and the corresponding value of x.

Let
$$y = 15$$
, then $15^2 = 15(2x+1)$
 $15 = 2x + 1$
ANNEXE $x = 7$

Answer
$$x = \frac{7}{15}$$
 [2]







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24 Simplify $\frac{3x^2 + 6x}{x^4 - 16}$.

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

15

Answer
$$\frac{3x}{(x-2)(x^2+4)}$$
Answer [3]

Solve the equation $x^2 - 12x + 17 = 0$ by completing the square. Give your solutions correct to 2 decimal places.

$$(x - 6)^{2} - 6^{2} + 17 = 0$$

$$(x - 6)^{2} = 19$$

$$x - 6 = \pm \sqrt{19}$$

$$x = 6 \pm \sqrt{19}$$

$$= 1.64 \text{ or } 10.36$$

Answer
$$x = 1.64$$
 or 10.36 [3]







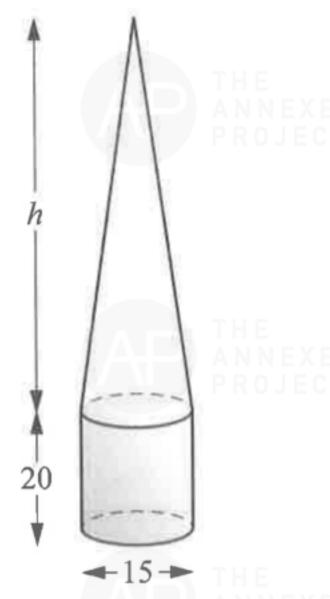
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26 (a)

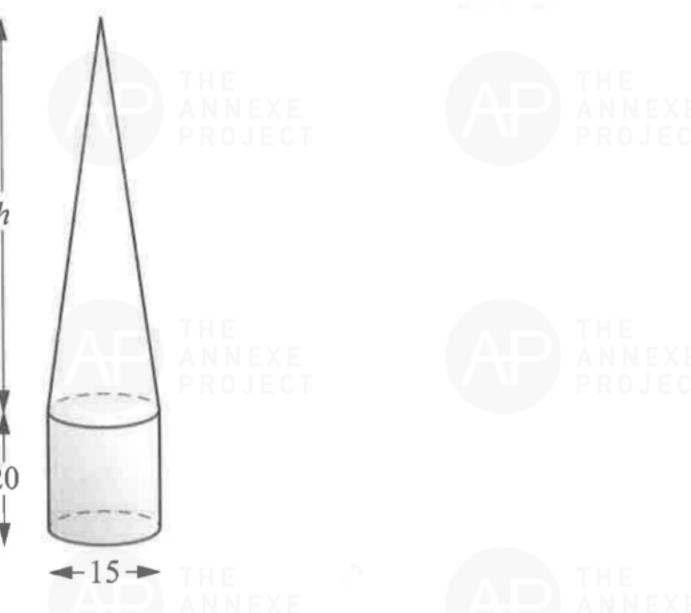


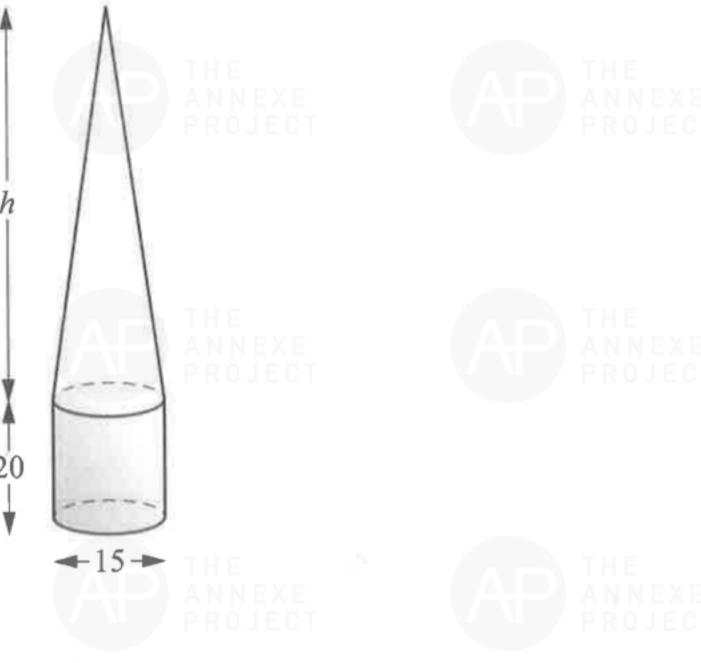




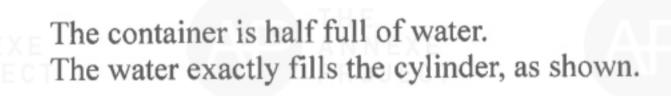


16





A sealed container is made by joining a cylinder to a cone. The cylinder has diameter 15 cm and height 20 cm. The cone has diameter $15 \, \text{cm}$ and height $h \, \text{cm}$.



Find the value of h.

Vol. of cone = Vol. of cylinder
$$\frac{1}{3} \times \pi r^{2} h = \pi r^{2} \times 20$$

$$h = 60 \text{ cm}$$



$$h = 60 \text{ cm}$$





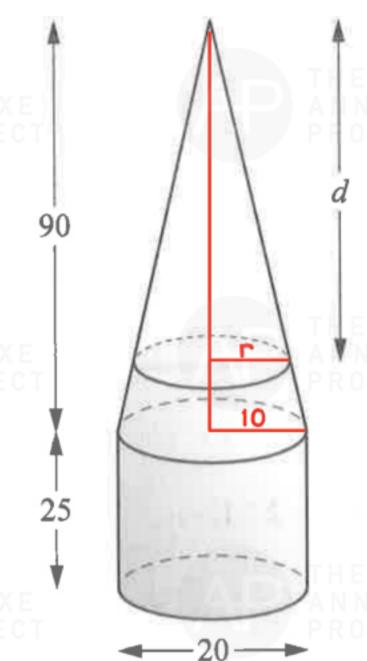


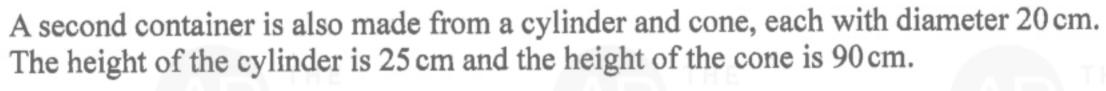












The container is half full of water, as shown.

Calculate the depth, dcm, of the empty space.

Step1:
By similar
$$\triangle$$

$$\frac{d}{90} = \frac{r}{10}$$

$$10d = 90r$$

$$r = \frac{d}{9}$$

Step 2:
vol. of empty space = vol. of water

$$\frac{1}{3}\pi r^2 d = \pi(10^2)(25) + \left[\frac{1}{3}\pi(10^2)(90) - \frac{1}{3}\pi r^2 d\right]$$

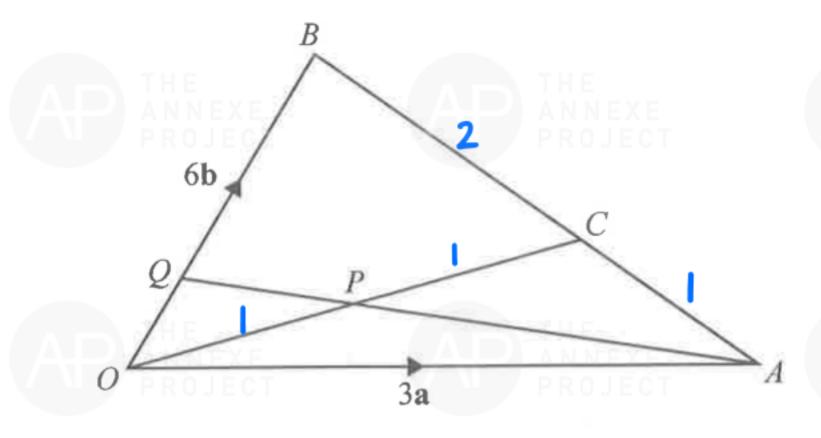
 $\frac{1}{3}\left(\frac{d}{9}\right)^2 d = 2500 + 3000 - \frac{1}{3}\left(\frac{d}{9}\right)^2 d$
 $\frac{2}{3}\left(\frac{d}{9}\right)^2 d = 5500$
 $\frac{2}{243} d^3 = 5500$
 $d^3 = 668250$

Answer
$$d = \frac{87.4 \text{ cm}}{(4)}$$

The suggested solutions are prepared by Mr Alvin Yeo. Mr Yeo will hold no liability for any errors.

= 87.4 cm





OAB is a triangle.

C is the point on BA such that BC : CA = 2 : 1.

 $\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 6\mathbf{b}$.

(a) Show that the position vector of C is given by $\overrightarrow{OC} = 2\mathbf{a} + 2\mathbf{b}$.

Answer

$$\overrightarrow{BA} = \overrightarrow{BO} + \overrightarrow{OA} = {}^{-6}\cancel{b} + {}^{3}\cancel{a}$$

$$\overrightarrow{BC} = \frac{2}{3} \overrightarrow{BA} = {}^{-4}\cancel{b} + {}^{2}\cancel{a}$$

$$\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC} = {}^{6}\cancel{b} - {}^{4}\cancel{b} + {}^{2}\cancel{a} = {}^{2}\cancel{a} + {}^{2}\cancel{b}$$

(b) P is the midpoint of OC and Q is a point on OB such that APQ is a straight line. AQ = mAP and OQ = nOB where m and n are numbers.

Find the ratio OQ : QB.

Given
$$\overrightarrow{AQ} = m \overrightarrow{AP}$$

Given $\overrightarrow{AQ} = m \overrightarrow{AP}$
 $\overrightarrow{OQ} - \overrightarrow{OA} = m(\overrightarrow{OP} - \overrightarrow{OA})$
 $\overrightarrow{OQ} = \overrightarrow{OA} + m(\overrightarrow{OP} - \overrightarrow{OA})$
 $\overrightarrow{OQ} = \overrightarrow{OA} + m(\overrightarrow{OP} - \overrightarrow{OA})$
 $\overrightarrow{OQ} = \overrightarrow{OA} + m(\cancel{Q} + \cancel{D} - \cancel{OA})$
 $\overrightarrow{OQ} = 3\cancel{Q} + m(\cancel{Q} + \cancel{D} - \cancel{OA})$
 $\overrightarrow{OQ} = (3-2m)\cancel{Q} + m\cancel{D}$
 $\overrightarrow{OQ} = \cancel{OA} + \cancel{OA}$

Comparing 1 & 2:
$$3-2m=0$$
 and $6n=m$ $m=\frac{3}{2}$ $n=\frac{1}{4}$

Since
$$\overrightarrow{OQ} = \overrightarrow{4} \overrightarrow{OB}$$

then $\overrightarrow{OQ} : \overrightarrow{QB} = 1:3$

Answer

· **3**

[4]

The area of triangle $OBC = 25 \text{ cm}^2$.

Find the area of triangle OAC.

Answer

Area of \triangle OBC = $\frac{1}{2} \times 2 \times K$ Area of \triangle OAC = $\frac{1}{2} \times 1 \times K$

area of \triangle OAC = $\frac{1}{2} \times 25$

 $= 12.5 \text{ cm}^2$

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THE ANNEXE PROJECT

