

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

CANDIDATE
NAME



CENTRE
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MATHEMATICS

4048/01

Paper 1

October/November 2022

2 hours

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 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 of the marks for this paper is 80.

This document consists of 16 printed pages.



Singapore Examinations and Assessment Board



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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 the questions.

1 Calculate $\sqrt[5]{12.5^2 - \frac{6.8}{0.037}}$.

Using calculator = -1.9408

Answer -1.94 [1]

2 Simplify.

(a) $3y^5 \times 5y^3 = (3 \times 5)(y^5 \times y^3) = 15y^8$

Answer $15y^8$ [1]

(b) $3(2x-1) - 2 = 6x - 3 - 2 = 6x - 5$

Answer $6x - 5$ [1]

- 3 [1] 25, 32, 16, 19, 40, 32, 14, 32

(a) Find the median of the set of numbers.

Step 1: Arrange the numbers in ascending order

14, 16, 19, 25, 32, 32, 32, 40

Step 2: $\frac{25 + 32}{2} = 28.5$

Answer 28.5 [1]

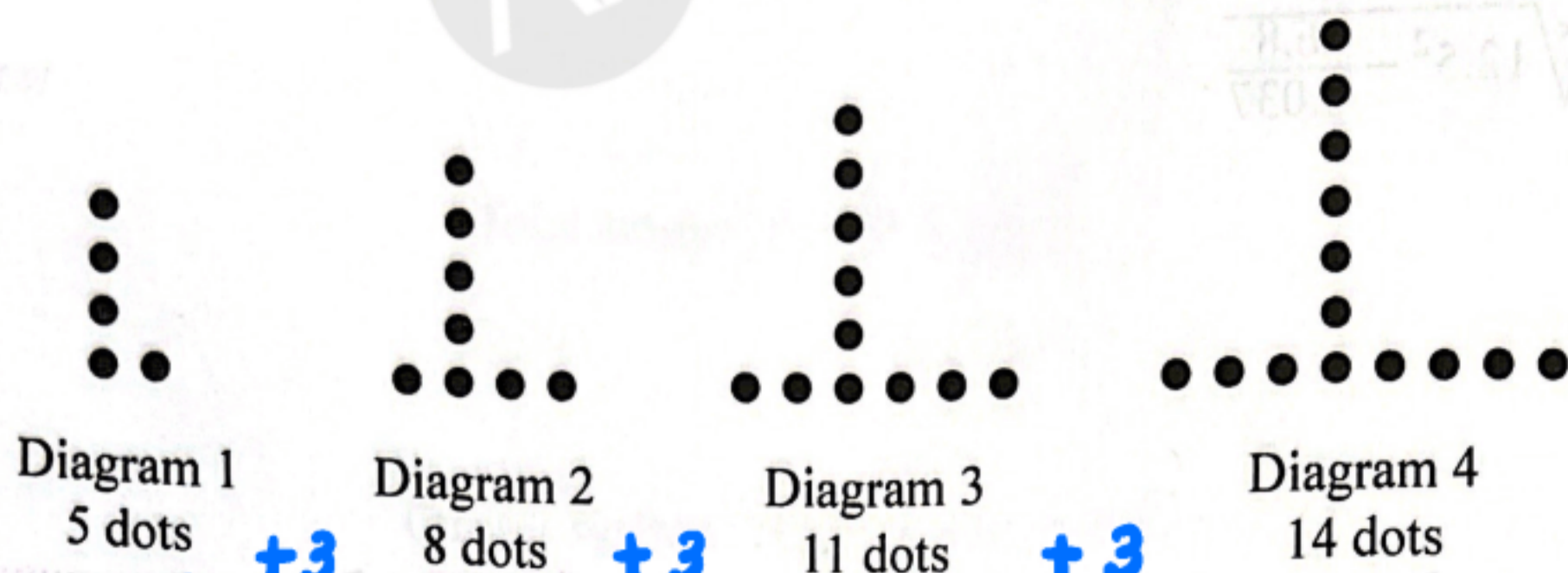
(b) Find the range of the set of numbers.

Range = $40 - 14 = 26$

Answer 26 [1]



4 The first four diagrams in a sequence are shown below.



(a) Find the number of dots in Diagram 8.

$$14 + 3 + 3 + 3 + 3 = 26$$

Answer **26** [1]

(b) Find an expression, in terms of n , for the number of dots in Diagram n .

Answer **$3n + 2$** [2]

(c) Explain why it is not possible to have a diagram with 157 dots.

$$\text{Let } 3n + 2 = 157$$

$$3n = 155, \text{ hence } n = 51\frac{2}{3}$$

Since n has to be an integer, it is not possible for a diagram with 157 dots. [1]



- 5 (a) A bag contains pink counters, blue counters and yellow counters. A counter is picked at random from the bag.

The probability that the counter is blue is $\frac{2}{5}$.

The probability that the counter is yellow is $\frac{2}{15}$.

Find the probability that the counter is pink.

$$1 - \frac{2}{5} - \frac{2}{15} = \frac{7}{15}$$

$$\frac{7}{15}$$

Answer [1]

- (b) Another bag contains 8 red counters and 16 green counters. More red counters are added to the bag.

The probability of picking a green counter from this bag at random is now $\frac{1}{4}$.

Find the number of red counters added to the bag.

Let x be the number of red counters added :

$$\frac{16}{24+x} = \frac{1}{4}$$

$$24+x = 64$$

$$\therefore x = 40$$

$$40$$

Answer [2]

- 6 The mass of a small pot is a kg. The mass of a large pot is b kg.

Ajay buys 4 small pots and 2 large pots with a total mass of 119 kg. Bhanu buys 5 small pots and 3 large pots with a total mass of 165 kg.

Form and solve two simultaneous equations to find the mass of a small pot and the mass of a large pot.

$$4a + 2b = 119$$

$$5a + 3b = 165$$

$$\therefore 12a + 6b = 357 \text{ --- (1)}$$

$$\therefore 10a + 6b = 330 \text{ --- (2)}$$

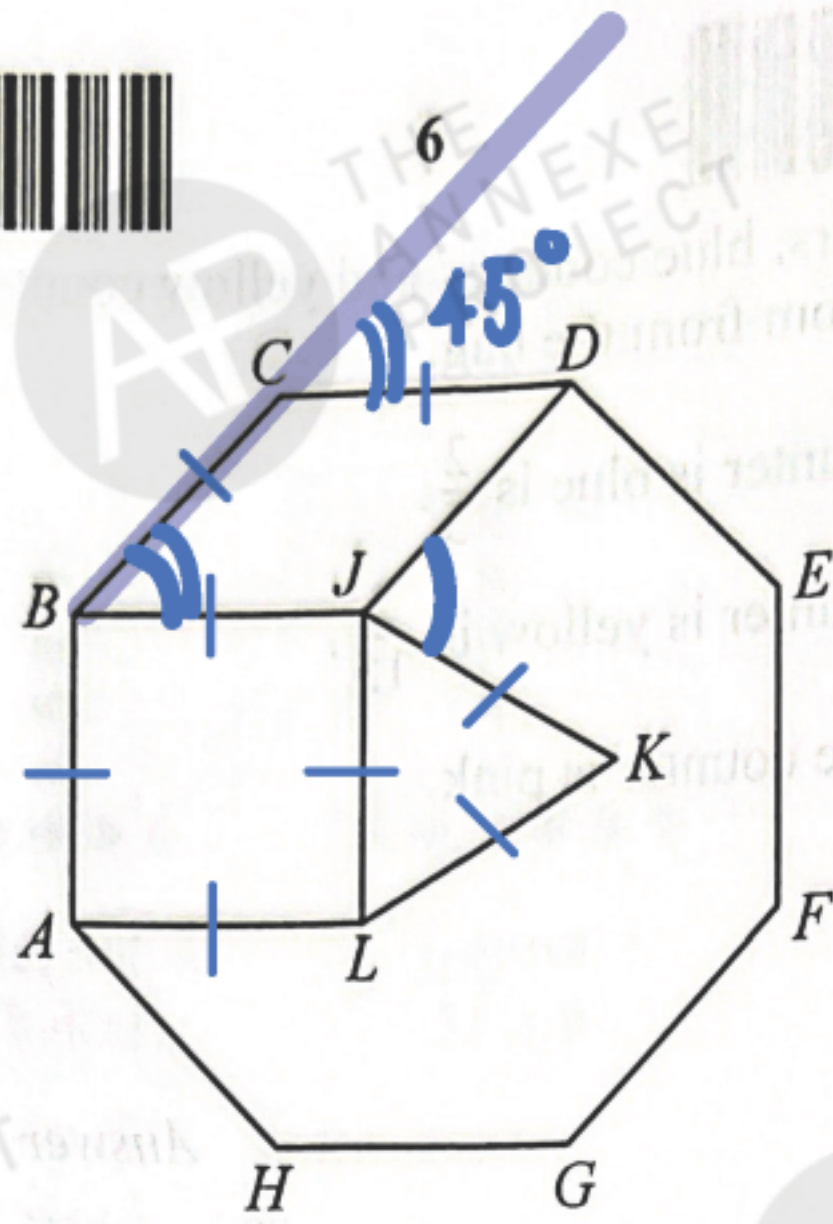
$$\textcircled{1} - \textcircled{2} : 2a = 27$$

$$a = \underline{13.5}$$

$$\text{Hence, } b = \underline{32.5}$$

Answer Small pot 13.5 kg

Large pot 32.5 kg [3]



The diagram shows a regular octagon, a square, an equilateral triangle and a quadrilateral.

(a) Find angle BCD.

$$\text{exterior } \angle = \frac{360^\circ}{8} = 45^\circ$$

$$\text{Here, } \angle BCD = 180^\circ - 45^\circ \text{ (}\angle\text{s on str. line)}$$

$$= 135^\circ$$
 Answer Angle BCD = **135°** [2]

(b) Explain why the quadrilateral BCDJ is a rhombus.

$$BC = CD = BA \text{ (sides of regular octagon)}$$

$$BA = BJ \text{ (sides of a square)}$$

$$\text{Hence, } BC = BJ = CD.$$

$$\angle CBJ = \angle CBA - \angle ABJ = 135^\circ - 90^\circ = 45^\circ$$

$$BJ \parallel CD \text{ (corresponding } \angle\text{s)}$$

(c) Find angle KJD.

$\therefore BCDJ$ is a rhombus.

$$\angle KJD = 360^\circ - \angle LJK - \angle BJL - \angle BJD$$

$$= 360^\circ - 60^\circ - 90^\circ - 135^\circ = 75^\circ$$
 Answer Angle KJD = **75°** [1]

8 A box measures 84 cm by 60 cm by 36 cm. The box is completely filled with identical cubes.

Find the minimum number of cubes required.

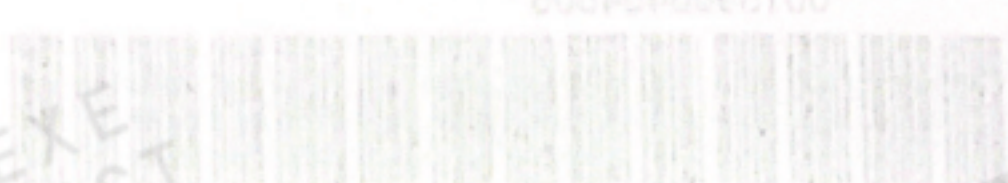
$$2 \times 2 \times 3$$

$$= 12 \text{ cm (length of a side of cube)}$$

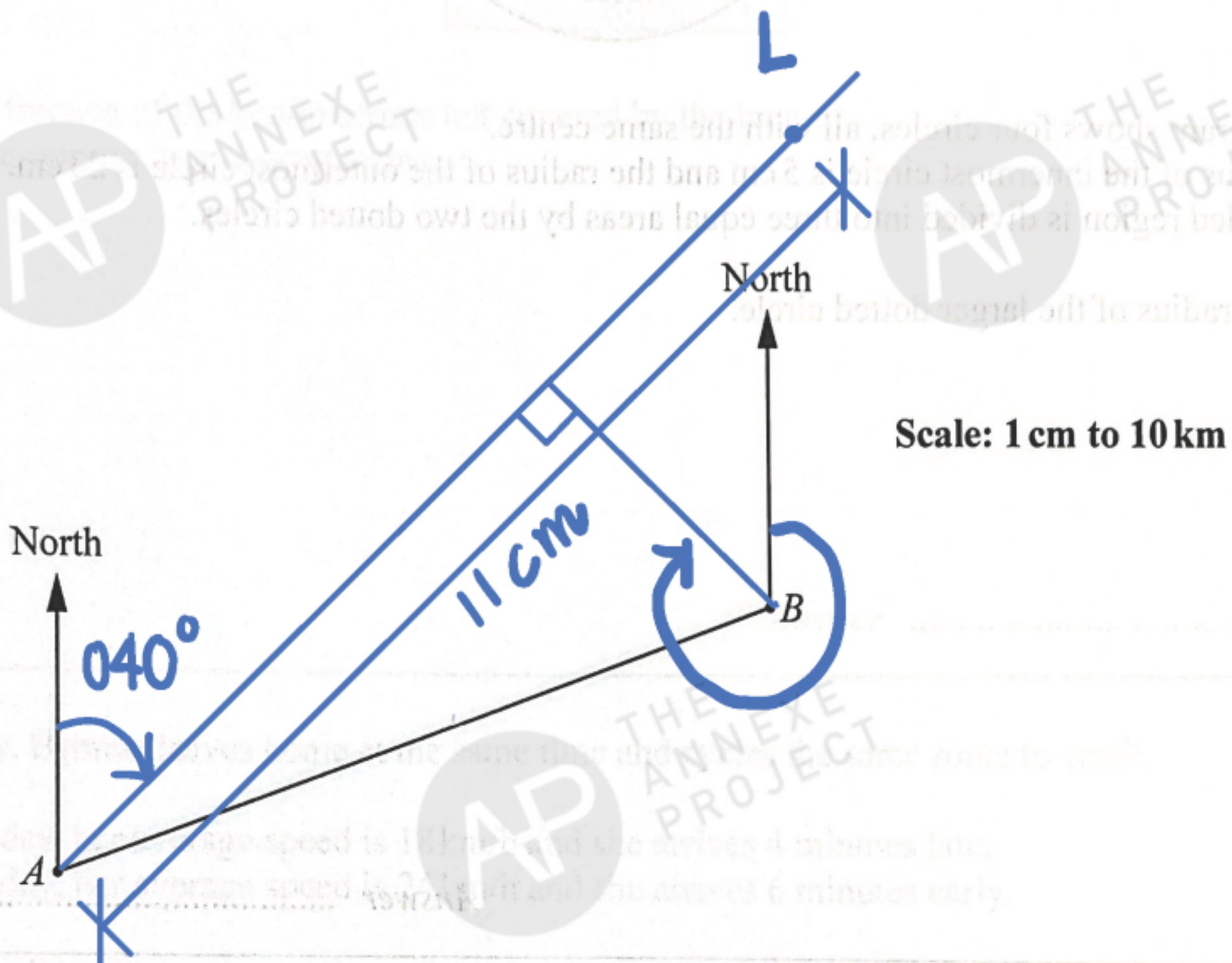
$$\frac{84 \times 60 \times 36}{12 \times 12 \times 12} = 105 \text{ cubes}$$

2	36, 60, 84
2	18, 30, 42
3	9, 15, 21
	3, 5, 7

Answer **105** [2]



9 In this scale drawing, A and B are two ports.

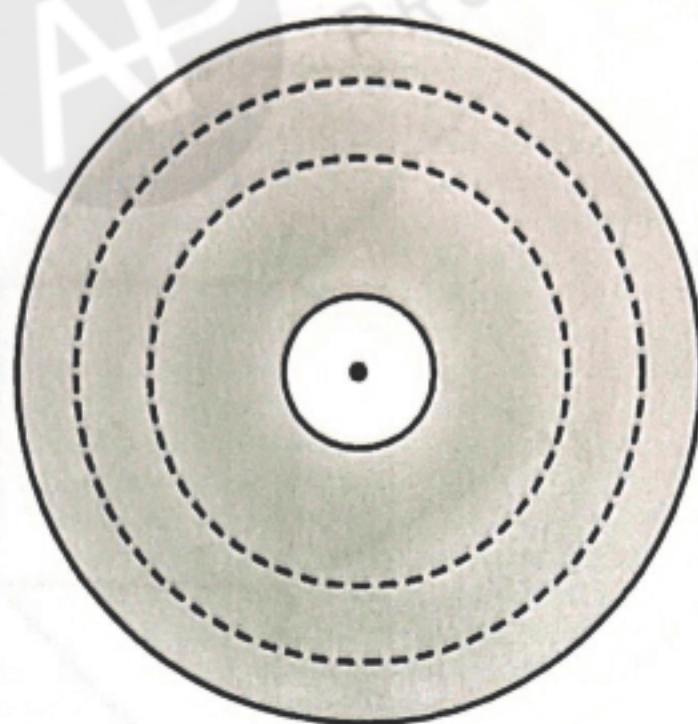


A boat leaves A and sails on a bearing of 040° to a lighthouse 110 km away.

- (a) Mark and label on the drawing the position, L , of the lighthouse. [2]
- (b) A second boat leaves B to meet the first boat at sea. When they meet, the second boat has sailed the shortest possible distance.

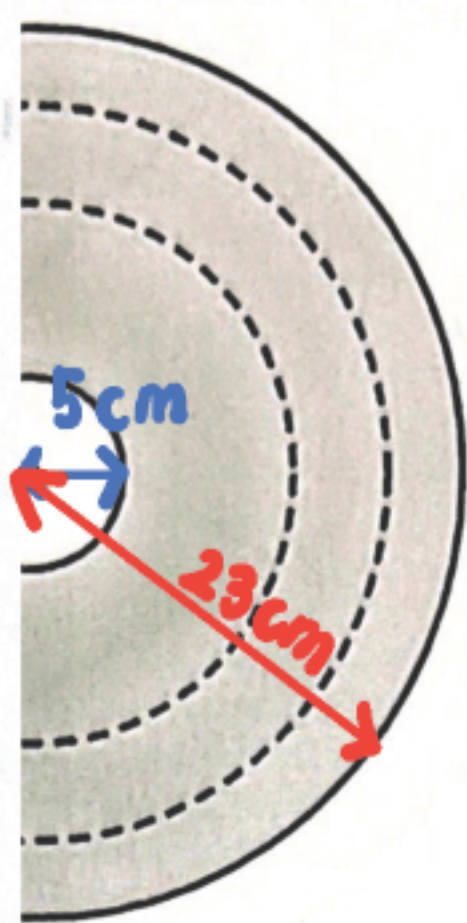
Find the bearing the second boat sails on.

Answer **$310^\circ - 320^\circ$** [2]



The diagram shows four circles, all with the same centre.
 The radius of the innermost circle is 5 cm and the radius of the outermost circle is 23 cm.
 The shaded region is divided into three equal areas by the two dotted circles.

Find the radius of the larger dotted circle.



$$\frac{\pi(23)^2 - \pi(5)^2}{3} = 168\pi$$

Let R be the radius of larger dotted circle.

$$\pi R^2 = \pi(5)^2 + 168\pi + 168\pi$$

$$R^2 = 25 + 168 + 168$$

$$R = \underline{19 \text{ cm}}$$

Answer 19 cm [3]

11 (a) Factorise completely $30 - 45a$.

Answer $15(2 - 3a)$ [1]

(b) Expand and simplify $(5x - 4y)^2$.

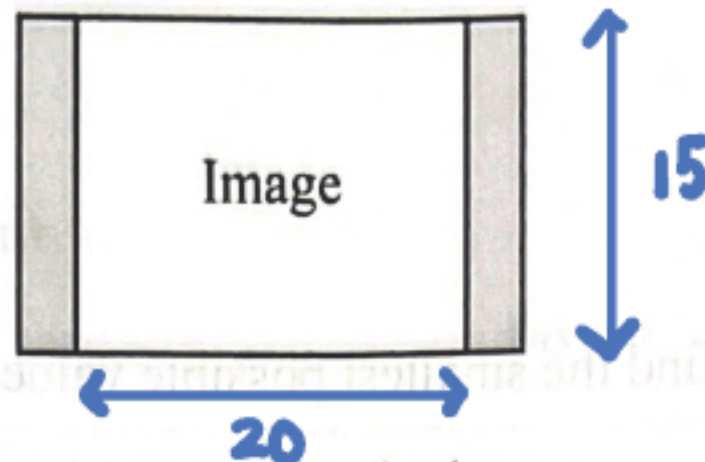
$$= 25x^2 - 40xy + 16y^2$$

Answer $25x^2 - 40xy + 16y^2$ [2]

- 12 A television screen has sides in the ratio width : height = 4 : 3.
A laptop screen has sides in the ratio width : height = 8 : 5.

An image exactly fills the television screen.

The same image only fills the height of the laptop screen and not the width, as shown in the diagram.



Find the fraction of the laptop screen not covered by the image.
Give your answer in its lowest terms.

The image fills the height of both screens, hence
television width : height = $4 \times 5 : 3 \times 5$
 $= 20 : 15$

laptop width : height = $8 \times 3 : 5 \times 3$
 $= 24 : 15$

$$\text{Required fraction} = \frac{4 \times 15}{24 \times 15} = \frac{1}{6}$$

Answer $\frac{1}{6}$ [3]

- 13 Each day, Behnaz leaves home at the same time and cycles the same route to work.

On Monday, her average speed is 18 km/h and she arrives 4 minutes late.

On Tuesday, her average speed is 24 km/h and she arrives 6 minutes early.

- (a) The time taken to travel to work on Monday is represented by t minutes.

Write an expression, in terms of t , for the time, in minutes, taken to travel to work on Tuesday.

If Behnaz was punctual on Monday,
she would have taken $(t-4)$ mins.

\therefore she took $(t-4) - 6 = (t-10)$ mins.

Answer $(t-10)$ minutes [1]

- (b) Form an equation in t to find the time taken to travel to work on Monday.

$$18 \times \frac{t}{60} = 24 \times \frac{t-10}{60}$$

$$18t = 24(t-10)$$

$$24t - 18t = 240$$

$$6t = 240$$

$$t = 40$$

Answer 40 minutes [3]



- 14 Niluka thinks of an integer.
 He multiplies it by 6 and subtracts 20.
 He multiplies the answer by 2 and subtracts 30.
 His final answer is greater than 1000.

(a) Using x to represent Niluka's integer, write down an inequality in x .

Answer $2(6x - 20) - 30 > 1000$ [2]

(b) Solve your inequality to find the smallest possible value of x .

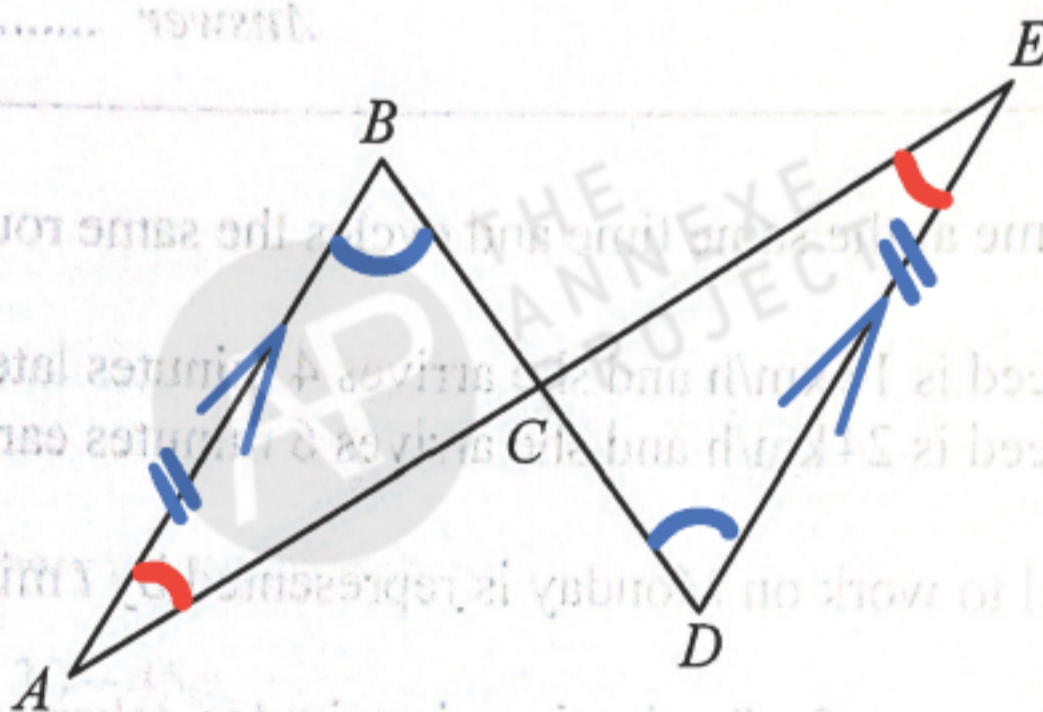
$$12x - 40 - 30 > 1000$$

$$12x > 1070$$

$$x > 89.2$$

Answer 90 [2]

15



In the diagram, AB and DE are equal in length and parallel.
 ACE and BCD are straight lines.

Show that BD bisects AE .
 Give a reason for each statement you make.

Answer

$\angle ABC = \angle CDE$ (alt. \angle s, $AB \parallel DE$)

$\angle BAC = \angle CED$ (alt. \angle s, $AB \parallel DE$)

$AB = DE$ (given)

By ASA, $\triangle ABC$ is congruent to $\triangle EDC$.

Hence, $AC = EC$.

i.e. C is the midpoint of AE .

We conclude that BD bisects AE .

[4]

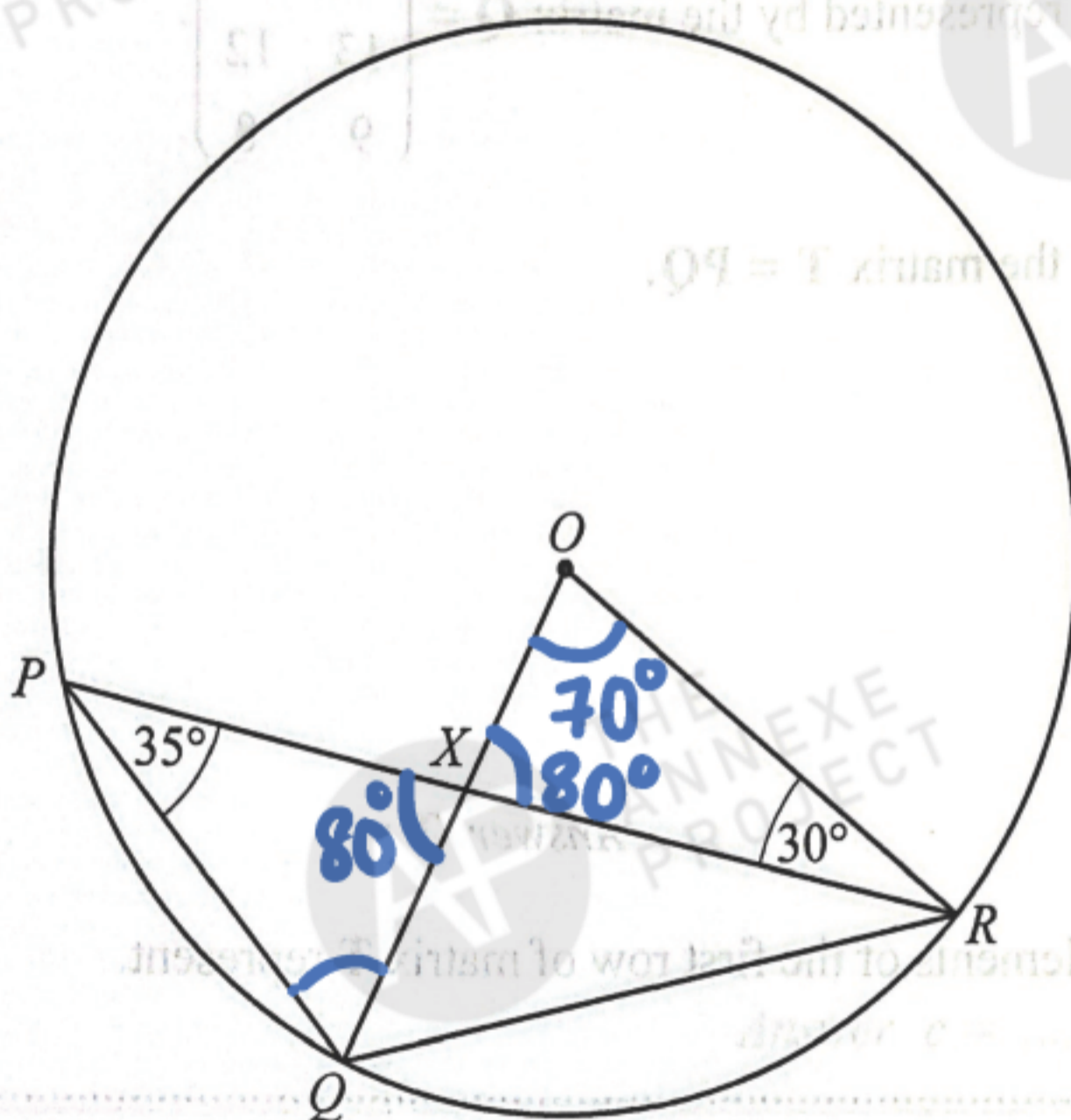


16 Factorise $4x^2 + 4x - 15$.

$$(2x-3)(2x+5)$$

Answer [2]

17



P , Q and R are three points on a circle, centre O .

Angle $QPR = 35^\circ$ and angle $ORP = 30^\circ$.

OQ and PR cross at the point X .

Find angle OQP .

Give reasons for each step of your working.

$$\angle QOR = 2 \times \angle QPR$$

$$= 70^\circ \quad (\angle \text{ at centre} = 2 \times \angle \text{ at circumference})$$

$$\angle OXR = 180^\circ - 70^\circ - 30^\circ$$

$$= 80^\circ \quad (\text{sum of } \angle \text{s in } \triangle \text{ is } 180^\circ)$$

$$\angle PXQ = 80^\circ \quad (\text{vert. opp } \angle \text{s, } \angle \text{PXR \& } \angle \text{OXR} \\ \text{are straight lines})$$

$$\angle OQP = 180^\circ - 80^\circ - 35^\circ = 65^\circ$$

$$(\text{sum of } \angle \text{s in } \triangle \text{ is } 180^\circ)$$

Answer Angle $OQP = \dots\dots\dots 65^\circ$ [4]



18 Cheng and Xin are each tiling a bathroom.

Cheng needs 5 packs of floor tiles, 10 packs of wall tiles, 4 bags of adhesive and 2 bags of grout.
 Xin needs x packs of floor tiles, $(x + 2)$ packs of wall tiles, 2 bags of adhesive and 1 bag of grout.

This information can be represented by the matrix $P = \begin{pmatrix} 5 & 10 & 4 & 2 \\ x & x+2 & 2 & 1 \end{pmatrix}$.

In a store, a pack of floor tiles costs \$140, a pack of wall tiles \$105, a bag of adhesive \$13 and a bag of grout \$9.

From an online supplier, a pack of floor tiles costs \$150, a pack of wall tiles \$100, a bag of adhesive \$12 and a bag of grout \$8.

This information can be represented by the matrix $Q = \begin{pmatrix} 140 & 150 \\ 105 & 100 \\ 13 & 12 \\ 9 & 8 \end{pmatrix}$.

(a) Find, in terms of x , the matrix $T = PQ$.

$$\begin{pmatrix} 5 & 10 & 4 & 2 \\ x & x+2 & 2 & 1 \end{pmatrix}_{2 \times 4} \begin{pmatrix} 140 & 150 \\ 105 & 100 \\ 13 & 12 \\ 9 & 8 \end{pmatrix}_{4 \times 2} = \begin{pmatrix} 1820 & 1814 \\ 245x + 245 & 250x + 232 \end{pmatrix}$$

Answer $T =$ [2]

(b) Explain what the elements of the first row of matrix T represent.

1820 represents how much Cheng would spend at a store and 1814 from an online supplier. [1]

(c) The online price for Xin's order is \$2 more than the price in the store.

Find x .

$$\begin{aligned} 250x + 232 &= 245x + 245 + 2 \\ 5x &= 15 \\ x &= 3 \end{aligned}$$

Answer $x =$ 3 [2]

(d) Xin orders all her items from the store or she orders all her items from the online supplier.

Find the lowest price she could pay for all her items.

$$\begin{aligned} \text{store} &= 245(3) + 245 \\ &= \underline{\underline{\$980}} \end{aligned}$$

Answer \$ 980 [1]

- 19 Given that $5 \sin x = 2$, find the two possible values for angle x , where $0^\circ \leq x \leq 180^\circ$.

$$\sin x = \frac{2}{5}$$

$$x = 23.6^\circ \text{ or } 180^\circ - 23.6^\circ \\ = 156.4^\circ$$

Answer $x = 23.6^\circ$ or 156.4° [2]

20

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

Rearrange the formula to make c the subject.

$$(3a + 2c)(3b) = 5 - c$$

$$9ab + 6bc = 5 - c$$

$$6bc + c = 5 - 9ab$$

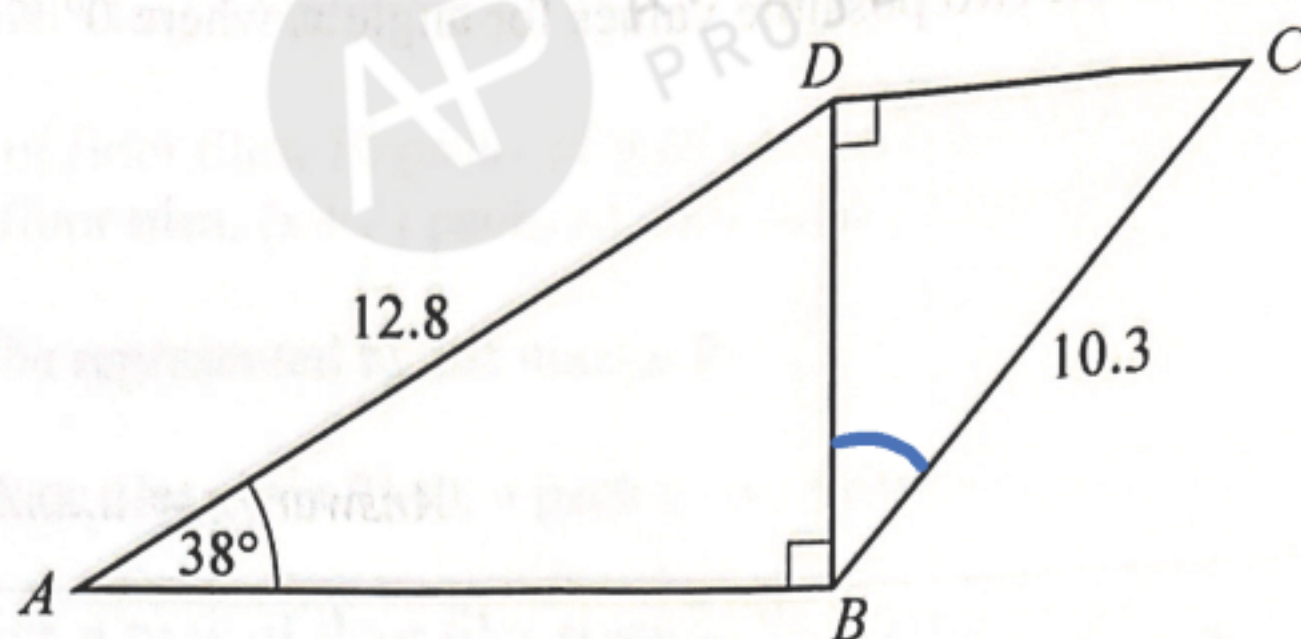
$$c = \frac{5 - 9ab}{6b + 1}$$

Answer $c = \frac{5 - 9ab}{6b + 1}$ [3]

- 21 Write as a single fraction in its simplest form $\frac{3}{2x-3} - \frac{2}{3x-2}$.

$$\frac{3(3x-2) - 2(2x-3)}{(2x-3)(3x-2)} \\ = \frac{9x - 6 - 4x + 6}{(2x-3)(3x-2)} \\ = \frac{5x}{(2x-3)(3x-2)}$$

Answer $\frac{5x}{(2x-3)(3x-2)}$ [3]



The diagram shows a trapezium $ABCD$.

Angle $ABD = \text{angle } BDC = 90^\circ$.

$AD = 12.8 \text{ cm}$, $BC = 10.3 \text{ cm}$ and angle $DAB = 38^\circ$.

Calculate angle CBD .

$$\sin 38^\circ = \frac{BD}{12.8}$$

$$\begin{aligned} \therefore BD &= 12.8 \times \sin 38^\circ \\ &= \underline{7.8805} \end{aligned}$$

$$\cos \angle CBD = \frac{7.8805}{10.3}$$

$$\angle CBD = \underline{40.1^\circ}$$

Answer Angle $CBD = \underline{40.1^\circ}$ [3]

23 Given that $25^{2x} = 125^7$, find x .

$$(5^2)^{2x} = (5^3)^7$$

$$5^{4x} = 5^{21}$$

$$\therefore 4x = 21$$

$$x = \frac{21}{4}$$

Answer $x = \underline{\frac{21}{4}}$ [2]



24 The table shows the monthly salaries of a group of 30 employees.

Monthly salary, m (\$)	Frequency
$2400 \leq m < 2500$	3
$2500 \leq m < 2600$	5
$2600 \leq m < 2700$	14
$2700 \leq m < 2800$	8
	$\Sigma f = 30$

(a) Calculate an estimate for

(i) the mean monthly salary of the employees,

$$\frac{3(2450) + 5(2550) + 14(2650) + 8(2750)}{30}$$

Answer \$ 2640 [1]

(ii) the standard deviation of the monthly salaries.

Answer \$ 90.74 [1]

(b) Each of the employees is to be given a salary increase of \$60 per month.

Explain how the mean and standard deviation will change after the salary increase.

Mean increases by \$60.

No change to standard deviation.

[1]



25 Some bacteria were introduced into a culture.

The number, N , of bacteria t hours after being introduced is given by $N = m \times 2^{3t}$, where m is the number of bacteria introduced.

(a) After 1 hour, the number of bacteria has increased to 2000.

Find m .

$$2000 = m \times 2^3$$

$$\therefore m = \frac{2000}{8}$$

$$= 250$$

Answer $m = \dots\dots\dots 250 \dots\dots\dots$ [1]

(b) Find, in terms of k , the number of bacteria when $8^t = k$.

$$N = 250 \times (2^3)^t$$

$$= 250 \times 8^t$$

$$= 250 \times k$$

Answer $N = \dots\dots\dots 250k \dots\dots\dots$ [1]

(c) Find the increase in the number of bacteria after 2 hours as a percentage of the number of bacteria originally introduced.

When $t = 2$ h: $N = 250 \times 2^6$
 $= 16000$

$$\frac{16000 - 250}{250} \times 100\% = 6300\%$$

Answer $\dots\dots\dots 6300 \dots\dots\dots$ % [2]

(d) Which of these diagrams represents the graph of N against t ?

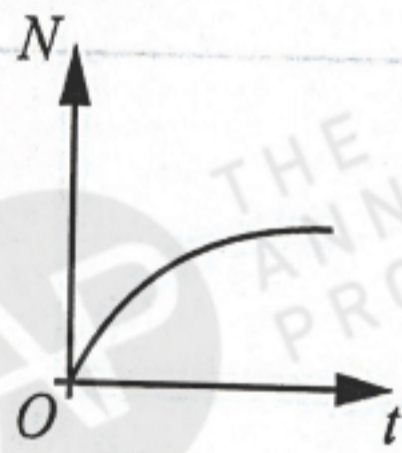


Diagram 1

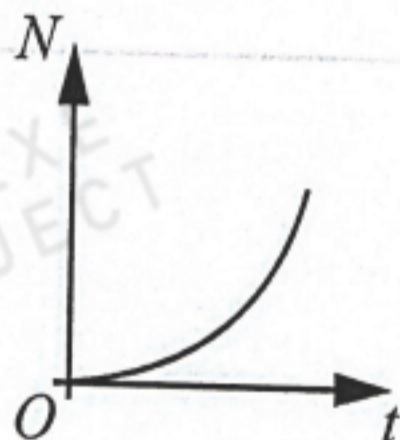


Diagram 2

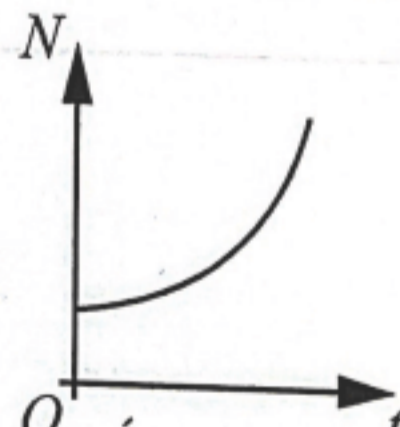


Diagram 3

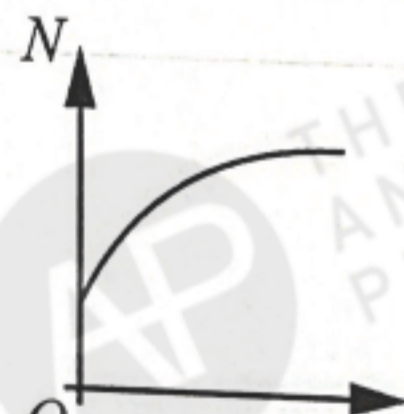


Diagram 4

Answer Diagram $\dots\dots\dots 3 \dots\dots\dots$ [1]

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