

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

CANDIDATE
NAME



CENTRE
NUMBER

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MATHEMATICS

4052/01

Paper 1

October/November 2025

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.

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



Singapore Examinations and Assessment Board



Cambridge Assessment
International Education

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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

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

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

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Answer **all** the questions.

$$1 \quad W = \frac{\sqrt{a}}{b+c}$$

Calculate the value of W when $a = 1234$, $b = 5.67$ and $c = 8.9$.

$$W = \frac{\sqrt{1234}}{(5.67 + 8.9)} \\ = 2.41$$

Answer **2.41** [1]

- 2 These ingredients are needed to make 8 scones.

275 g flour
60 g butter
150 ml milk
30 g sugar

- (a) Cheng uses 150 g of butter to make some scones.

How many scones does he make?

$$\frac{150}{60} = 2.5 \\ 2.5 \times 8 = 20$$

Answer **20** [1]

- (b) Mei has 700 ml of milk and 900 g of each of the other ingredients.

- (i) Calculate the maximum number of scones she can make.

$$\frac{900}{275} = 3.27 \\ 3.27 \times 8 = 26.2 \approx 26$$

Answer **26** [2]

- (ii) Calculate the amount of butter she uses to make this maximum number of scones.

$$26 \times \frac{60}{8} = 195$$

Answer **195** g [1]

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- 3 Samira invests \$5250 for 4 years.
The money earns simple interest at a rate of 2.4% per year.

Find the total amount of money she has at the end of 4 years.

$$\begin{aligned}
 A &= \frac{PRT}{100} + 5250 \\
 &= \frac{5250 \times 2.4 \times 4}{100} + 5250 \\
 &= \$5754
 \end{aligned}$$

Answer \$ 5754 [2]

- 4 Chen is selling 19.2 grams of gold.
He is offered \$58.11 per gram.

Each of these calculations can be used to estimate how much money he will receive.

A: 58×19

B: 60×20

C: 55×20

Which of these calculations overestimates the amount he receives?
Without doing any calculation, explain how you know.

Calculation B because 60 is rounded up from 58.11 and 20 is rounded up from 19.2. Hence, 60×20 is an over-estimation. [1]



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5 (a) Solve $3c - 4 = 9c + 17$.

$$9c - 3c = -4 - 17$$

$$6c = -21$$

$$c = -3.5$$

Answer $c = \dots -3.5 \dots$ [2]

(b) Factorise $8ab - 3 + 12a - 2b$.

$$8ab + 12a - 3 - 2b$$

$$= 4a(2b + 3) - (2b + 3)$$

$$= (4a - 1)(2b + 3)$$

Answer $\dots (4a - 1)(2b + 3) \dots$ [2]

(c) Expand and simplify $(4x + 3y)(3x - 4y)$.

$$(4x + 3y)(3x - 4y) = 12x^2 - 16xy + 9xy - 12y^2$$

$$= 12x^2 - 7xy - 12y^2$$

Answer $\dots 12x^2 - 7xy - 12y^2 \dots$ [2]



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- 6 (a) Solve the inequalities $-43 < 2(5x+3) - 14 \leq 42$.

$$-43 < 10x + 6 - 14 \leq 42$$

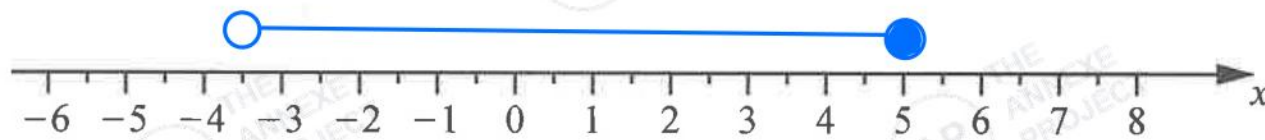
$$-43 < 10x - 8 \leq 42$$

$$-35 < 10x \leq 50$$

$$-3.5 < x \leq 5$$

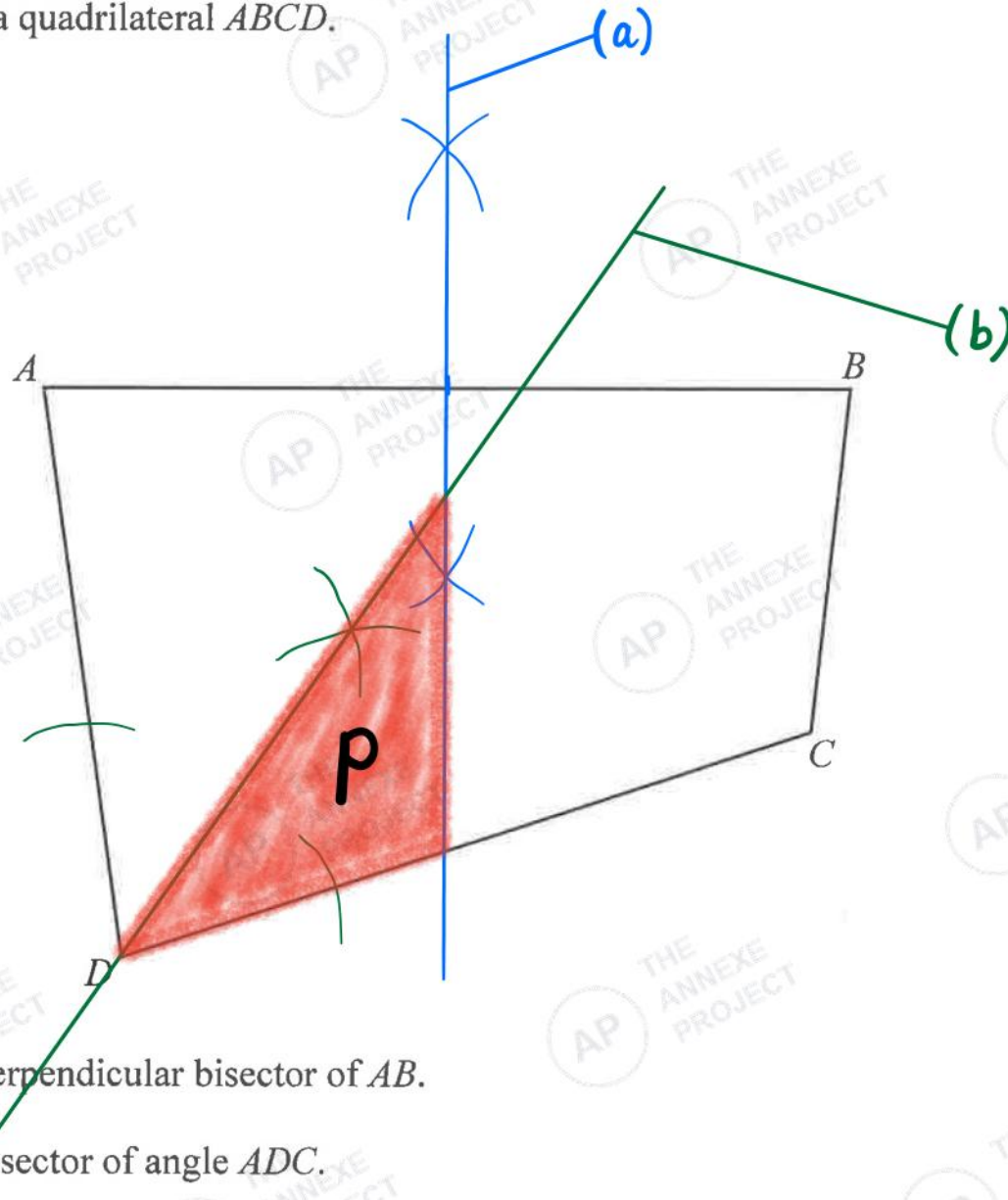
Answer $-3.5 < x \leq 5$ [3]

- (b) Represent your answer to part (a) on this number line.



[1]

- 7 The diagram shows a quadrilateral $ABCD$.



- (a) Construct the perpendicular bisector of AB . [1]
 (b) Construct the bisector of angle ADC . [1]
 (c) A point P is to be plotted inside the quadrilateral.
 It is to be closer to A than B , and closer to CD than AD .

Shade the region where P can be plotted.

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- 8 P is the point $(4, -1)$.

$$\overrightarrow{PQ} = \begin{pmatrix} -7 \\ 10 \end{pmatrix}.$$

- (a) Find the coordinates of point Q .

$$\begin{aligned} \overrightarrow{PQ} &= \overrightarrow{OQ} - \overrightarrow{OP} \\ \therefore \overrightarrow{OQ} &= \overrightarrow{PQ} + \overrightarrow{OP} \\ &= \begin{pmatrix} -7 \\ 10 \end{pmatrix} + \begin{pmatrix} 4 \\ -1 \end{pmatrix} = \begin{pmatrix} -3 \\ 9 \end{pmatrix} \end{aligned}$$

Answer (-3 , 9) [1]

- (b) Find the magnitude of $\overrightarrow{PQ}$.

$$\begin{aligned} |\overrightarrow{PQ}| &= \sqrt{(-7)^2 + 10^2} \\ &= \sqrt{149} = 12.2 \text{ units} \end{aligned}$$

Answer 12.2 [2]

- 9 The total surface area of a cube is 125 cm^2 .

Calculate the volume of the cube.

$$\text{Surface area of 1 face} = \frac{125}{6}$$

$$\therefore \text{length of 1 side of cube} = \sqrt{\frac{125}{6}} = 4.5644 \text{ cm}$$

$$\text{vol. of cube} = 4.5644^3 = 95.1 \text{ cm}^3$$

Answer 95.1 cm^3 [2]

- 10 (a) Written as a product of its prime factors, $5500 = 2^x \times 5^y \times 11$.

Find the values of x and y .

$$\begin{array}{r|l} 2 & 5500 \\ \hline 2 & 2750 \\ \hline 5 & 1375 \\ \hline 5 & 275 \\ \hline 5 & 55 \\ \hline 11 & 11 \\ \hline & 1 \end{array}$$

$$\therefore 5500 = 2^2 \times 5^3 \times 11$$

Answer $x =$ 2 , $y =$ 3 [1]

- (b) Written as a product of its prime factors, $793800 = 2^3 \times 3^4 \times 5^2 \times 7^2$.

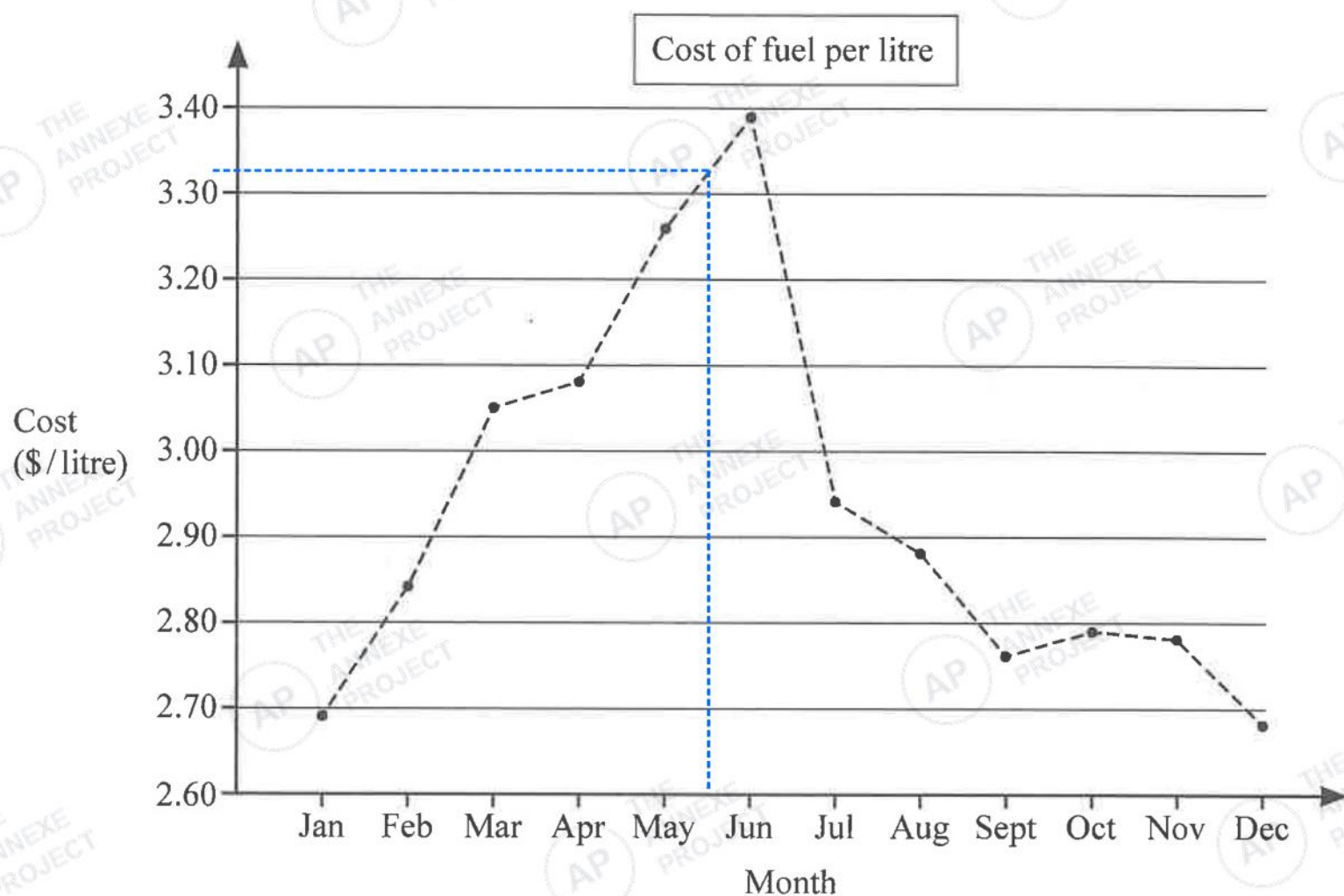
Find the smallest positive integer k such that $793800k$ is a cube number.

$$k = 3^2 \times 5 \times 7 = 315$$

Answer $k =$ 315 [1]

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- 11 Alex records the cost of fuel per litre at the end of each month. He draws this graph to show the information.



- (a) Sue says that the cost of fuel per litre in the middle of June was about \$3.32.

Explain why she may be wrong.

The cost of fuel per litre from end of May to end of June may not have followed a linear increment. [1]

- (b) Explain why the graph may **not** show the highest cost per litre.

The graph records the cost of fuel per litre at the end of each month, but the highest cost per litre could have occurred in the middle of a particular month. [1]

- (c) (i) State one misleading feature of the graph.

The vertical axis did not start from 0. [1]

- (ii) Explain how this feature affects the reader's interpretation of the graph.

The proportions of the graph could affect the reader's interpretation of the cost of fuel/litre. [1]

For eg. Feb's cost of fuel per litre looks like twice that of Jan when actually it is approximately 1.05 times only.



12

$$8a - 4b + 7 = 6c$$

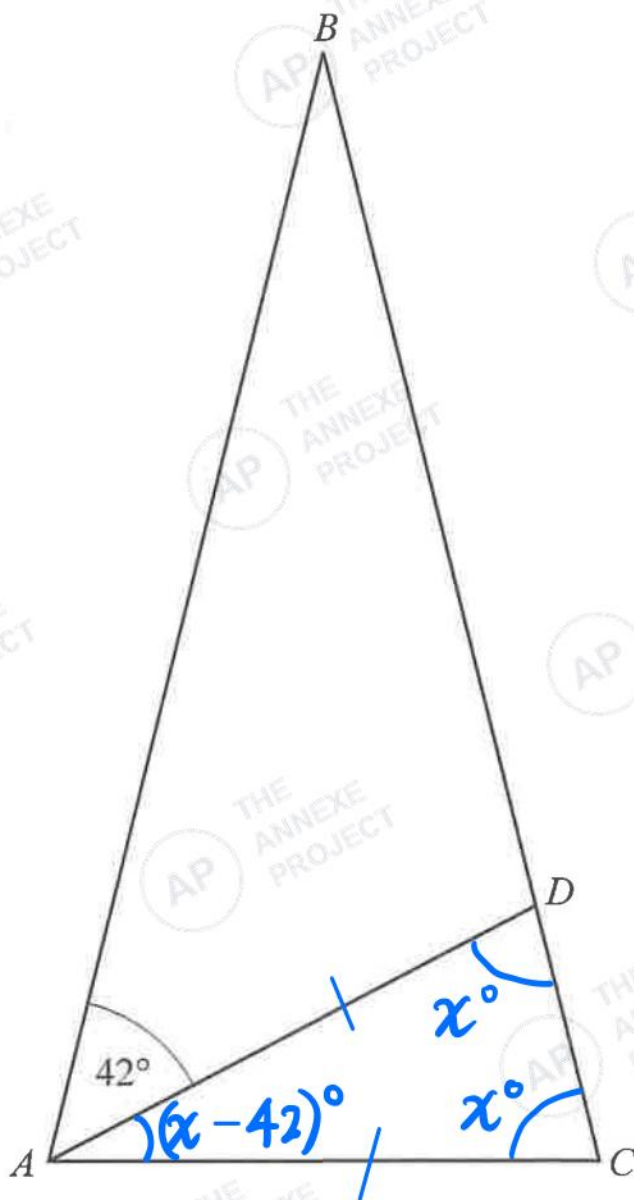
Explain why a , b and c cannot all be integers.

$$8a - 4b - 6c = -7$$

$$4a - 2b - 3c = -3.5$$

If a , b and c are integers, then $4a$, $2b$ and $3c$ are also integers. The sum or difference of integers will result in an integer, but -3.5 is not an integer. [1]

13



In the diagram, ABC is an isosceles triangle with $AB = BC$.
 D is a point on BC such that $AD = AC$.
 Angle $BAD = 42^\circ$.

Find angle ACD .

Let $\angle ACD = x^\circ$, then $\angle ADC = x^\circ$

Since $AB = BC$, then $\angle BAC = \angle BCA = x^\circ$

Hence $\angle DAC = (x - 42)^\circ$

$$x + x + x - 42 = 180^\circ$$

$$3x - 42 = 180$$

$$3x = 222$$

$$x = 74$$

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- 14 From 2018 to 2021, Singapore's Gross National Income (GNI) increased by 9.24%.

From 2018 to 2019, the GNI increased by 3.63%.

From 2019 to 2020, the GNI decreased by 5.56%.

Calculate the percentage increase in the GNI from 2020 to 2021.

Let GNI in 2018 be x .

then GNI in 2019 = $1.0363x$

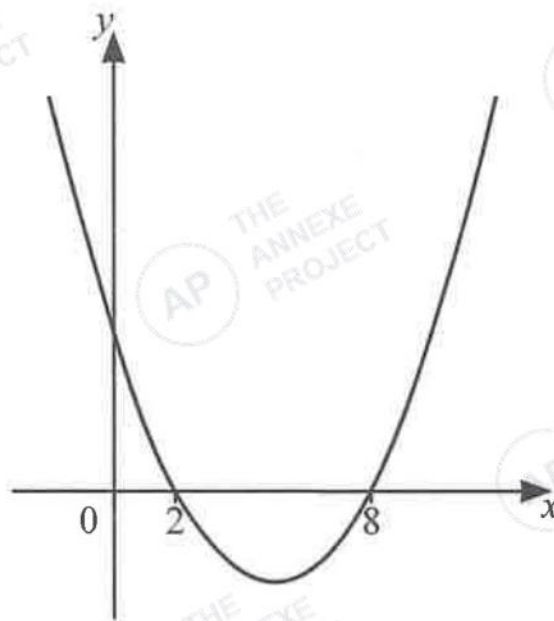
and GNI in 2020 = $(1 - 0.0556) \times 1.0363x$
 $= 0.97868x$

Given GNI in 2021 = $1.0924x$

Percentage increase from 2020 to 2021 = $\frac{1.0924x - 0.97868x}{0.97868x} \times 100\% = 11.6\%$

Answer 11.6 % [3]

15



The diagram shows a sketch of a quadratic curve.

- (a) It is given that the equation for the curve is of the form $y = x^2 + bx + c$.

Find the value of b and the value of c .

$$\begin{aligned} x^2 + bx + c &= (x-2)(x-8) \\ &= x^2 - 10x + 16 \end{aligned}$$

Answer $b = \dots -10 \dots$, $c = \dots 16 \dots$ [2]

- (b) A different quadratic curve also has roots $x = 2$ and $x = 8$.
 The intercept on the y -axis is 32.

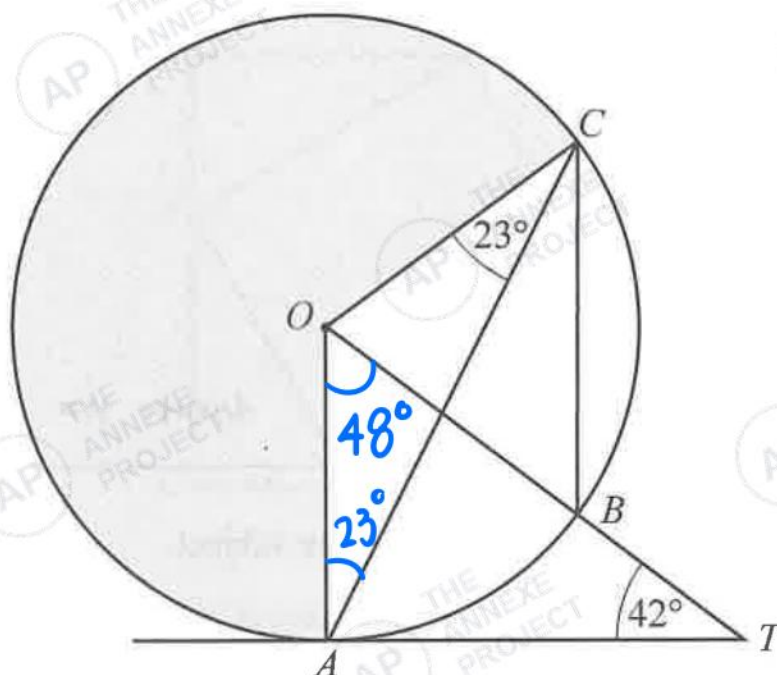
Find an equation for this curve.

$$\begin{aligned} y &= 2(x-2)(x-8) \\ &= 2(x^2 - 10x + 16) \\ &= 2x^2 - 20x + 32 \end{aligned}$$

Answer $y = \dots 2x^2 - 20x + 32 \dots$ [1]

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A, B and C are points on the circumference of a circle, centre O .

TA is a tangent to the circle.

OBT is a straight line.

Angle $OTA = 42^\circ$ and angle $OCA = 23^\circ$.

- (a) Give a reason why angle $OAT = 90^\circ$.

OA is the radius of the circle. Radius $\perp$ tangent at A ,
hence $\angle OAT = 90^\circ$

[1]

- (b) Find angle ACB .

Give a reason for each step of your working.

$$\begin{aligned}\angle AOB &= 180^\circ - 90^\circ - 42^\circ \\ &= 48^\circ \text{ (sum of } \triangle)\end{aligned}$$

$$\begin{aligned}\angle ACB &= \frac{1}{2} \times \angle AOB \\ &= 24^\circ \text{ (} \angle \text{ at } \odot = 2 \times \angle \text{ at circumference)}\end{aligned}$$

Answer Angle $ACB = 24^\circ$ [2]

- (c) The radius of the circle is 8.7 cm.

Calculate the area of the shaded sector OAC .

$$\angle OAC = \angle OCA = 23^\circ \text{ (base } \angle \text{s of isos. } \triangle)$$

$$\begin{aligned}\angle AOC &= 180^\circ - 2(23^\circ) \\ &= 134^\circ \text{ (sum of } \triangle)\end{aligned}$$

$$\text{reflex } \angle AOC = 360^\circ - 134^\circ = 226^\circ$$

$$\text{Area of shaded sector} = \frac{226^\circ}{360^\circ} \times \pi (8.7)^2 = 149.28$$

149

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17 Given that $343^4 = 49^{-5y}$, find y .

$$(7^3)^4 = (7^2)^{-5y}$$

$$\therefore 12 = -10y$$

$$y = -1.2$$

Answer $y = \dots\dots\dots -1.2 \dots\dots\dots$ [2]

18 Rearrange the formula $\frac{a}{2a-3} = \frac{3c}{d} + 1$ to make a the subject.

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

$$ad = (2a-3)(3c+d)$$

$$ad = 6ac + 2ad - 9c - 3d$$

$$\therefore 6ac + 2ad - ad = 9c + 3d$$

$$6ac + ad = 3(3c+d)$$

$$a(6c+d) = 3(3c+d)$$

$$a = \frac{3(3c+d)}{(6c+d)}$$

Answer $a = \dots\dots\dots \frac{3(3c+d)}{(6c+d)} \dots\dots\dots$ [3]

19 By completing the square, find the coordinates of the minimum point of the curve $y = x^2 + 6x + 11$. Show all your working.

$$y = (x+3)^2 - 3^2 + 11$$

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

$$\text{Min. point} = (-3, 2)$$

Answer ($\dots\dots\dots -3 \dots\dots\dots 2 \dots\dots\dots$) [3]

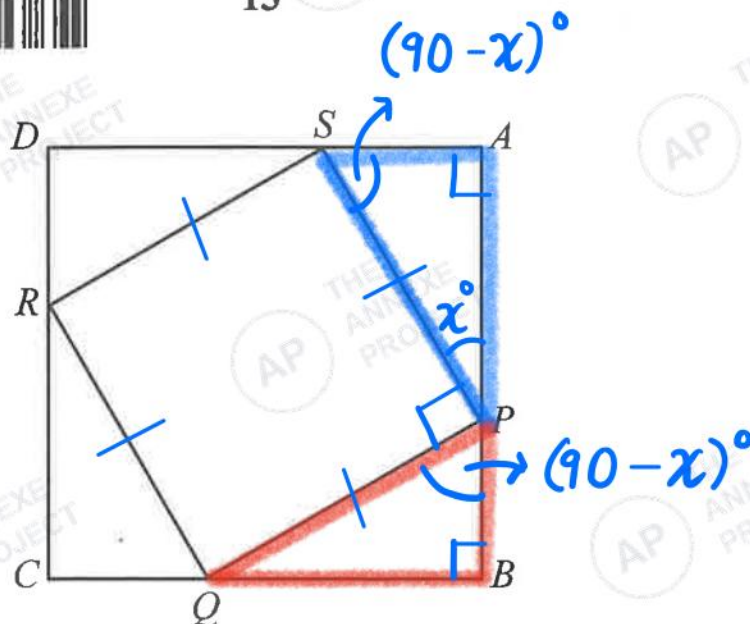


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The diagram shows two squares, $ABCD$ and $PQRS$.

- (a) Show that triangle APS and triangle BQP are congruent.
Give a reason for each statement you make.

Answer

$A \longleftrightarrow B$
 $P \longleftrightarrow Q$
 $S \longleftrightarrow P$

Let $\angle APS = x^\circ$

then $\angle ASP = 180^\circ - 90^\circ - x^\circ = (90 - x)^\circ$

$\angle BPQ = 180^\circ - 90^\circ - x^\circ$

$= (90 - x)^\circ$ ($\angle$ s on a straight line)

Hence $\angle ASP = \angle BPQ$

Also, $\angle SAP = \angle PBQ = 90^\circ$ ($ABCD$ is a square)

And $PS = QP$ ($PQRS$ is a square)

By ASA test, $\triangle APS$ is congruent to $\triangle BQP$. [3]

- (b) The perimeter of the larger square is 124 cm.
The perimeter of the smaller square is 100 cm.

Find the length of AP and the length of PB .

$sp = \frac{100}{4} = 25 \text{ cm}$

$AB = \frac{124}{4} = 31 \text{ cm}$

Let $PB = y$, then $AP = 31 - y$

$SA = PB = y$

By pythagoras' theorem,

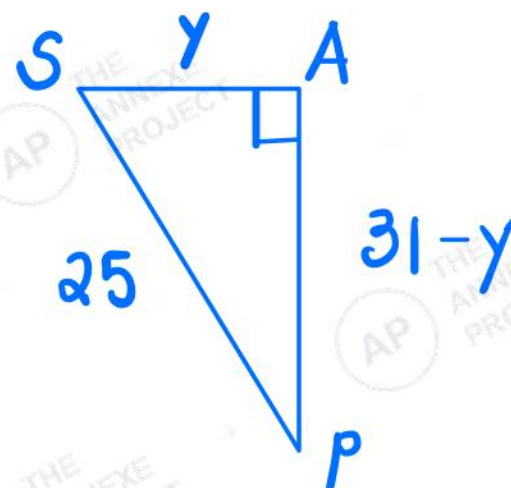
$25^2 = y^2 + (31 - y)^2$

$625 = y^2 + 961 - 62y + y^2$

$2y^2 - 62y + 336 = 0$

$y^2 - 31y + 168 = 0$

$(y - 7)(y - 24) = 0$



$\therefore y = 7 \text{ or } 24 \text{ (rej.)}$

$PB = 7$

and $AP = 31 - 7 = 24$

24

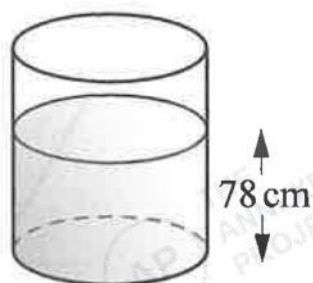
7

Answer $AP = \dots\dots\dots \text{cm}$, $PB = \dots\dots\dots \text{cm}$ [3]

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21 (a)



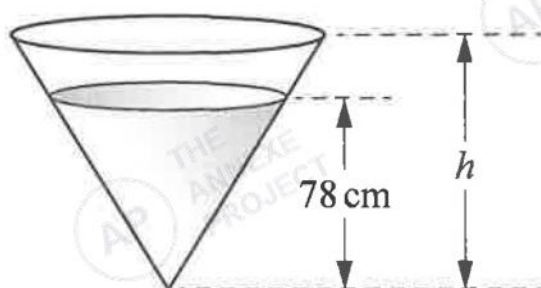
The diagram shows a cylindrical container.
It is 65% full of water.
The depth of the water is 78 cm.

Calculate the height of the container.

$$\begin{aligned} 65\% &= 78 \text{ cm} \\ 100\% &= \frac{78}{65} \times 100 = 120 \text{ cm} \end{aligned}$$

Answer 120 cm [2]

(b)



The diagram shows a conical container.
It is 65% full of water.
The depth of the water is 78 cm.

Calculate the height, h , of the container.

$$\frac{V_w}{V_c} = \frac{65}{100} = \frac{13}{20}$$

$$\frac{78}{h} = \sqrt[3]{\frac{13}{20}}$$

$$\frac{78}{h} = 0.866239$$

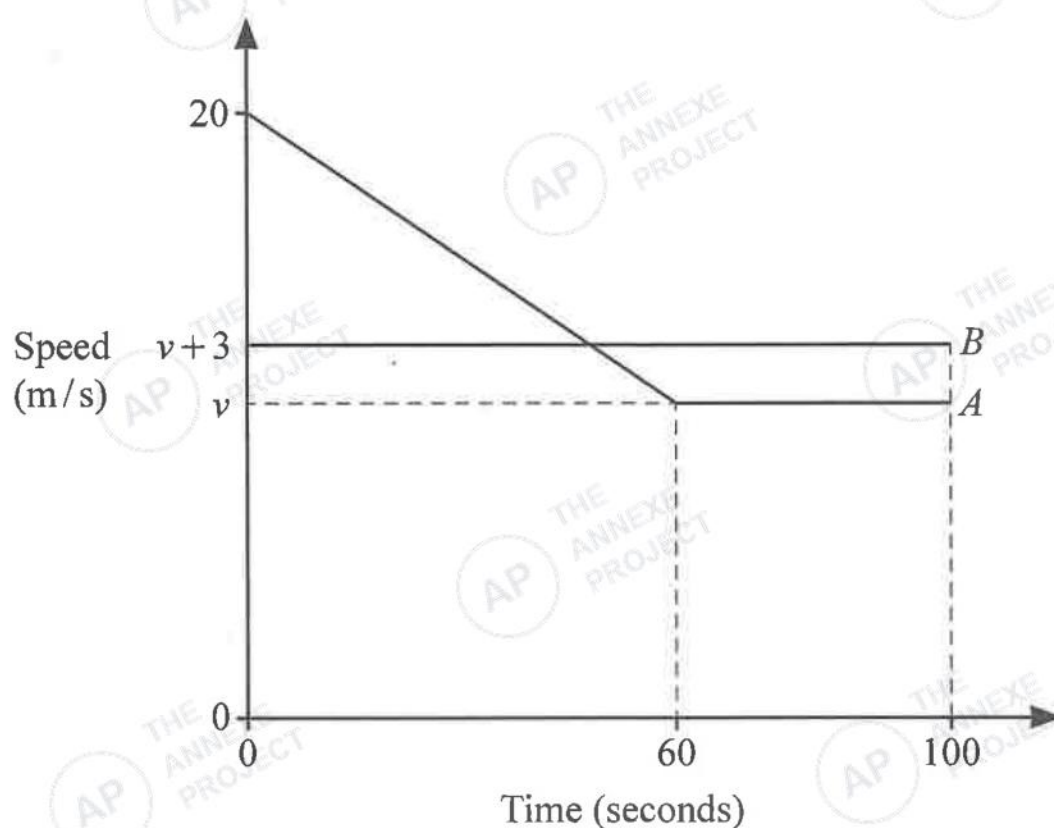
$$\therefore h = \frac{78}{0.866239} = 90.0$$

Answer $h =$ 90.0 cm [3]

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- 22 The diagram shows speed–time graphs for two cyclists, A and B , travelling along the same road in the same direction.



A decelerates from 20 m/s to $v\text{ m/s}$ and then travels at a constant speed of $v\text{ m/s}$.

B travels at a constant speed of $(v+3)\text{ m/s}$.

After 100 seconds B has travelled 75 m further than A .

The area beneath each speed–time graph represents the distance travelled by each cyclist.

Find the value of v .

$$\text{distance } B = \text{distance } A + 75$$

$$100(v+3) = \frac{60}{2}(20+v) + 40v + 75$$

$$100v + 300 = 600 + 30v + 40v + 75$$

$$30v = 375$$

$$v = 12.5\text{ m/s}$$

Answer $v = \underline{12.5\text{ m/s}}$ [4]



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

Show all your working.

Give your solutions correct to 2 decimal places.

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

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

$$6x^2 - 10x + 5x + 20 = 3(x+4)(3x-5)$$

$$6x^2 - 5x + 20 = 9x^2 + 21x - 60$$

$$3x^2 + 26x - 80 = 0$$

$$x = \frac{-26 \pm \sqrt{26^2 - 4(3)(-80)}}{2(3)}$$

$$= \frac{-26 \pm \sqrt{1636}}{6}$$

$$= -11.07 \text{ or } 2.41$$

Answer $x = -11.07$ or $x = 2.41$ [5]

24 Simplify $\left(\frac{16}{81a^4c^{12}}\right)^{-\frac{3}{4}}$, giving your answer in the form pa^qc^r , where p , q and r are constants.

$$\left(\frac{16}{81a^4c^{12}}\right)^{-\frac{3}{4}} = \left(\frac{81a^4c^{12}}{16}\right)^{\frac{3}{4}}$$

$$= \left(\frac{3^4a^4c^{12}}{2^4}\right)^{\frac{3}{4}} = \frac{(3^4)^{\frac{3}{4}}(a^4)^{\frac{3}{4}}(c^{12})^{\frac{3}{4}}}{(2^4)^{\frac{3}{4}}}$$

$$= \frac{3^3a^3c^9}{2^3} = \frac{27}{8}a^3c^9$$

Answer [2]



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25 The table shows information about the masses of some kiwi fruits.

	<i>mid - value</i>	<i>72.5</i>	<i>76</i>	<i>78</i>	<i>80</i>	<i>83</i>
Mass (m grams)	$70 < m \leq 75$	$75 < m \leq 77$	$77 < m \leq 79$	$79 < m \leq 81$	$81 < m \leq 85$	
Frequency	8	8	7	5	4	

(a) Calculate an estimate for

(i) the mean mass,

$$\frac{8(72.5) + 8(76) + 7(78) + 5(80) + 4(83)}{32} = 77.0625$$

Answer *77.1* g [1]

(ii) the standard deviation of the masses.

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2} = \sqrt{\frac{190402}{32} - \left(\frac{2466}{32}\right)^2} = 3.3813597$$

Answer *3.38* g [1]

(b) The masses of some plums have a mean of 65.5 grams and a standard deviation of 3.83 grams.

Make two comments comparing the (1.) averages and (2.) distributions of the masses of the kiwi fruits and the plums.

1. *A kiwi is on average heavier than a plum.*

2. *The mass of the kiwi fruits are more consistent due to a smaller standard deviation.*

[2]

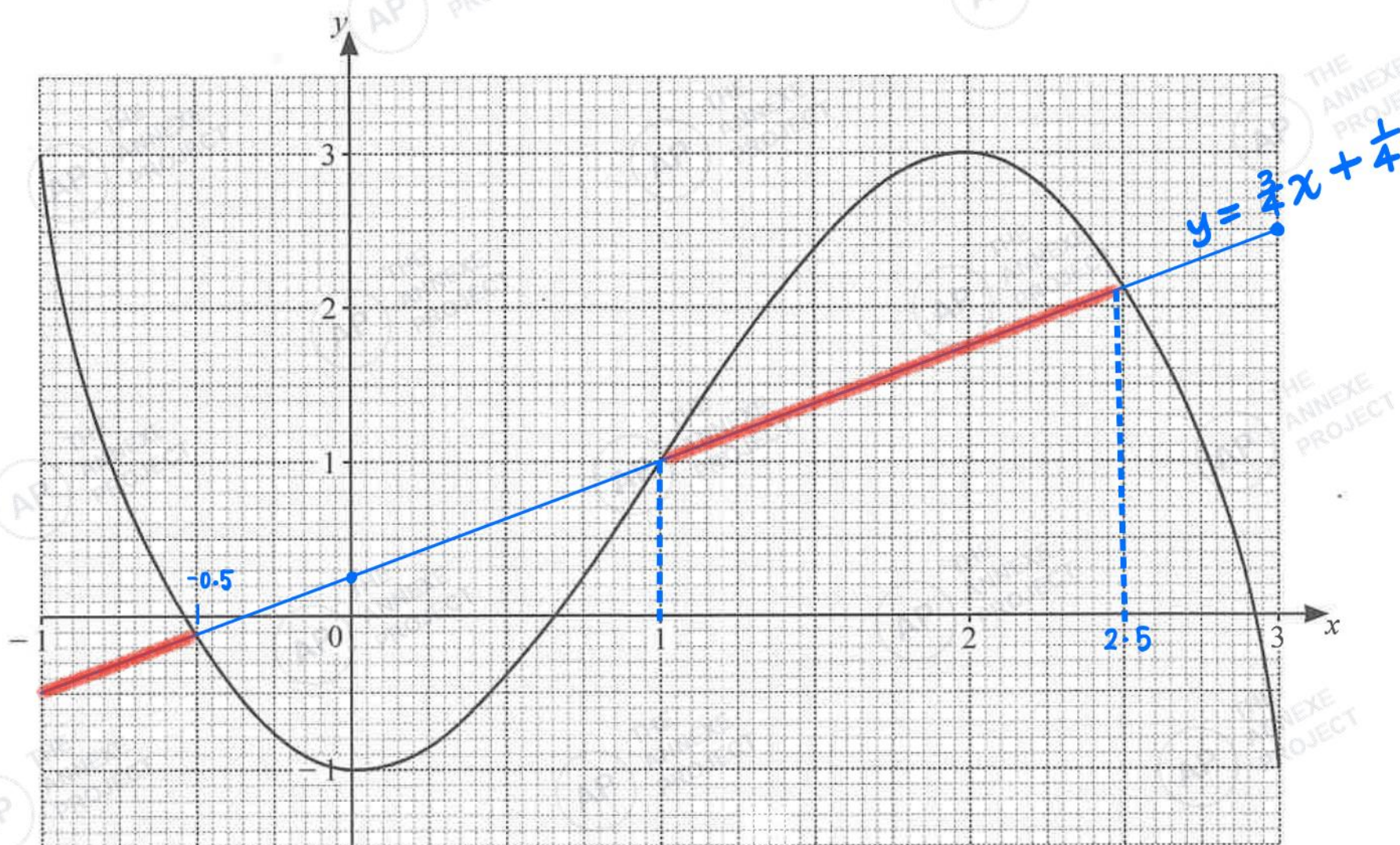


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26 The graph of $y = 3x^2 - x^3 - 1$ is drawn on the grid.



By drawing a suitable straight line on the grid, solve the inequality $4x^3 - 12x^2 + 3x + 5 < 0$.

$$4x^3 - 12x^2 + 3x + 5 < 0$$

$$3x + 5 < 12x^2 - 4x^3$$

$$\frac{3x+5}{4} < 3x^2 - x^3$$

$$\frac{3x+5}{4} - 1 < 3x^2 - x^3 - 1$$

$$\boxed{\frac{3}{4}x + \frac{1}{4}} < 3x^2 - x^3 - 1$$

insert this graph

$$\text{Plot } y = \frac{3}{4}x + \frac{1}{4}$$

x	0	3
y	$\frac{1}{4}$	$\frac{5}{2}$

Answer $x < -0.5$ or $1 < x < 2.5$ [4]

To solve $\frac{3}{4}x + \frac{1}{4} < 3x^2 - x^3 - 1$,
we want to find the range of values of x
that the straight line is below the curve (as highlighted
in red).

$$\text{i.e. } x < -0.5 \text{ or } 1 < x < 2.5$$

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- 27 Abid has two fair numbered spinners, Spinner X and Spinner Y .
The probability that Spinner X lands on an odd number is x .

(a) Write down an expression for the probability that Spinner X lands on an even number.

Answer $1 - x$ [1]

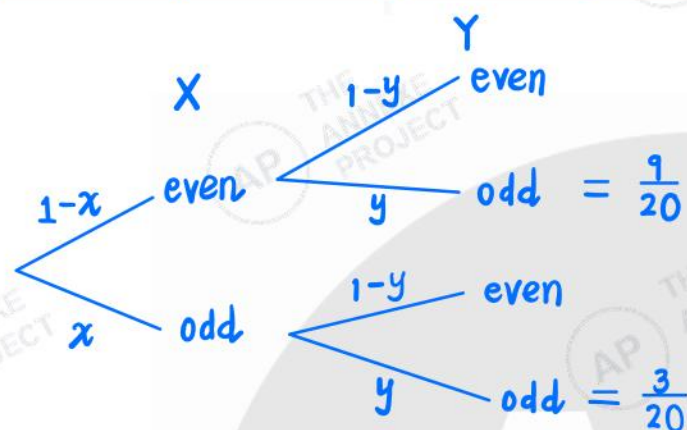
- (b) Abid spins the two spinners.

The probability that both spinners land on an odd number is $\frac{3}{20}$.

The probability that Spinner X lands on an even number **and** Spinner Y lands on an odd number is $\frac{9}{20}$.

Find the probability that both spinners land on an even number.

Let the probability that spinner Y lands on an odd number be y :



$$xy = \frac{3}{20} \quad \text{--- (1)}$$

$$(1-x)y = \frac{9}{20} \quad \text{--- (2)}$$

$$\textcircled{1}: y = \frac{3}{20x} \quad \text{--- (3)}$$

$$\text{sub (3) into (2): } (1-x) \frac{3}{20x} = \frac{9}{20}$$

$$(1-x)(3) = \frac{9}{20} \cdot 20x$$

$$3 - 3x = 9x$$

$$12x = 3$$

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

$$y = \frac{3}{20(\frac{1}{4})} = \frac{3}{5}$$

$$\therefore \text{Prob. both spinners land on even} = (1-x)(1-y) = (1-\frac{1}{4})(1-\frac{3}{5}) = 0.3$$

Answer [3]



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