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

CANDIDATE NAME

CENTRE NUMBER | S | | | | |

INDEX NUMBER | | | | |

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MATHEMATICS

4052/01

Paper 1

October/November 2026

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 or tape.
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

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Mathematical Formulae

Compound interest

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

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

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

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

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

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

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

Trigonometry

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

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

Statistics

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

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

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Answer **all** the questions.

1 **(a)** Simplify.

$6a-5(2a-3)$

$= 6a - 10a + 15$

$= 15 - 4a$

Answer ..... $15-4a$ ..... [1]

(b) Factorise.

$cd-c+d-1$

$= c(d-1) + (d-1)$

$= (d-1)(c+1)$

Answer ..... $(d-1)(c+1)$ ..... [2]

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2 **(a)** Write 120 as a product of its prime factors.
Give your answer in index form.

$2 \mid 120$
$2 \mid 60$
$2 \mid 30$
$3 \mid 15$
$5 \mid 5$
1

Answer $120 = 2^3 \times 3 \times 5$ [1]

(b) Two integers, A and B, are written as products of prime factors.

$A = p \times q^2 \times r^4$ $B = p^2 \times q \times r^3$ where $p > q > r$

(i) Find, in terms of p, q and r, the highest common factor (HCF) of A and B.

Answer $p \times q \times r^3$ [1]

(ii) The highest common factor (HCF) of A and B is 120.

Find the value of A.

Comparing (a) and b(i):
$r = 2$, $q = 3$, $p = 5$

$A = 5 \times 3^2 \times 2^4$
$= 720$

Answer $A =$ 720 [2]

(iii) Find the lowest common multiple (LCM) of A and B.
Give your answer as a product of its prime factors.

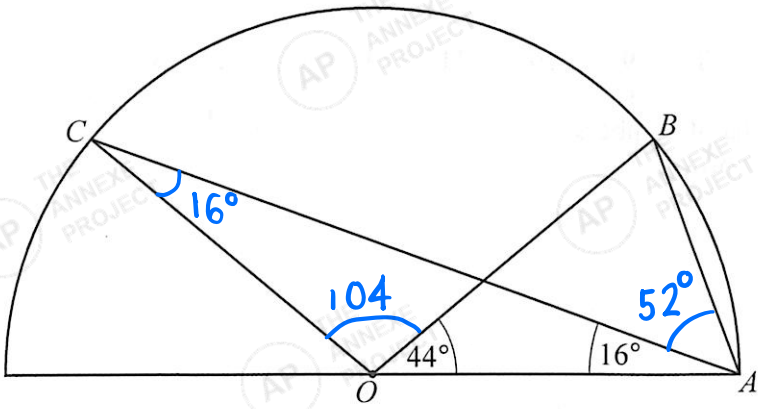
$LCM = p^2 \times q^2 \times r^4$
$= 5^2 \times 3^2 \times 2^4$

Answer $5^2 \times 3^2 \times 2^4$ [1]

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3



The diagram shows a semicircle, centre O.
A, B and C are points on the semicircle.
Angle $AOB = 44°$ and angle $OAC = 16°$.

(a) Find angle BOC.
Give a reason for your answer.

Angle BOC = 104° because $\angle OCA = 16°$ (base $\angle$s of isos. $\triangle$, $OC = OA$) and $\angle BOC = 180° - 16° - 16° - 44° = 104°$ (sum of $\triangle$) [2]

(b) Find angle BAC.
Give a reason for your answer.

Angle BAC = 52° because $\angle BOC = 2 \times \angle BAC$. ($\angle$ at $\odot$ = 2 x $\angle$ at $\odot$ce) [2]

---

4 In the expression $\frac{5x-3y+16x+17y}{5x-3y+x+7y}$, x and y are positive numbers.

Show that the value of the expression is the same for all values of x and y.

Answer

$$\frac{5x-3y+16x+17y}{5x-3y+x+7y} = \frac{21x+14y}{6x+4y}$$

$$= \frac{7(3x+2y)}{2(3x+2y)}$$

$$= \frac{7}{2} \text{ (a constant)}$$

Hence, for all values of x and y, the value of the expression is always a constant of $\frac{7}{2}$. [2]

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5 Here is a list of numbers.

8 8 9 10 11 12

Two more integers are added to the list of numbers.
The median is now 9 and the range is now 7.

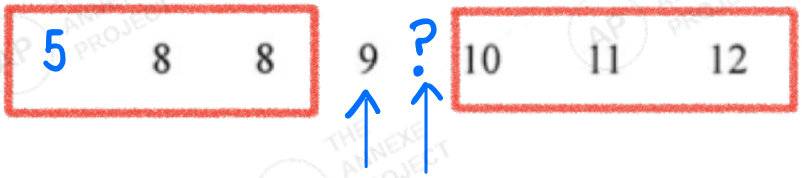
Find the two integers.

Answer 5 and 9 [2]

[Thought Process]

If the range is 7, we can add the smallest integer 5 (so that 5 to 12 has a range of 7) or we can add the largest integer 15 (so that 8 to 15 has a range of 7)

However, the median cannot be 9 if we add 15.
Hence, 5 is the one of the integer added to the list.



Since median is 9, the second integer added must be 9.
With a total of eight integers, the median is shared by the 4th and 5th integer.

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6 Omar cycles from village A to village B at an average speed of 18 km/h.
He then cycles from village B to village C at an average speed of 12 km/h.

The distance from village A to village B is the same as the distance from village B to village C.

(a) (i) Let x kilometres represent the distance between village A and village B.

Write down an expression in terms of x for the total time taken for Omar to cycle from village A to village C.

$\frac{x}{18} + \frac{x}{12} = \frac{2x}{36} + \frac{3x}{36} = \frac{5x}{36}$

Answer $\frac{5x}{36}$ hours [1]

(ii) Hence, find Omar's average speed for the journey from village A to village C.

Average speed $= \frac{\text{total distance}}{\text{total time}}$

$= \frac{2x}{\left(\frac{5x}{36}\right)} = \frac{72x}{5x} = 14.4$ km/h

Answer 14.4 km/h [2]

(b) Convert 12 km/h to metres per second.

$12 \text{ km/h} = \frac{12\,000 \text{ m}}{3600 \text{ s}} = 3\frac{1}{3}$

Answer $3\frac{1}{3}$ m/s [1]

---

7 The angle $x°$ is an obtuse angle and $\sin x° = 0.9867$.

Find the value of x. $x = \sin^{-1} 0.9867 = 80.6°$ (basic angle)

Since $\sin x°$ is a positive value, $x = 80.6°$ (rej.) or $180° - 80.6° = 99.4°$

Answer $x =$ ..... [1]

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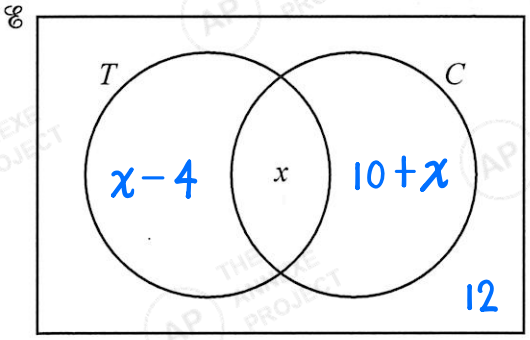
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8 72 adults were asked whether they visited a theatre (T) or a cinema (C) in the previous month.

- 12 did **not** visit a theatre or a cinema.
- The number who visited a theatre only was 4 less than the number who visited both.
- The number who visited a cinema only was 10 more than the number who visited both.

(a) Let x represent the number of adults who visited both.

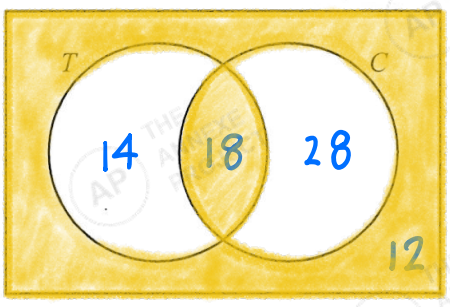
Find the value of x.
You may use the Venn diagram to help you.



$(x-4) + x + (10+x) + 12 = 72$
$3x + 18 = 72$
$3x = 72 - 18$
$x = \frac{54}{3}$
$= 18$

Answer $x =$ 18 [2]

(b) Find the value of $n((T \cap C) \cup (T \cup C)')$.



$n((T \cap C) \cup (T \cup C)') = 18 + 12$
$= 30$

Answer 30 [1]

(c) One of the adults that visited a theatre is picked at random.

Find the probability that the adult also visited a cinema.

Prob. $= \frac{18}{14+18} = \frac{18}{32} = \frac{9}{16}$

Answer $\frac{9}{16}$ [1]

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9 (a) Write 0.000 012 3 in standard form.

$0.0000123 = 1.23 \times 10^{-5}$

Answer ..... 1.23×10^{-5} ..... [1]

(b) In standard form, $A = 1.5 \times 10^n$ and $B = 4.8 \times 10^{n+1}$.

Find $\frac{5B}{A}$.

Give your answer in standard form.

$$\frac{5B}{A} = \frac{5 \times 4.8 \times 10^{n+1}}{1.5 \times 10^n} = \frac{24 \times 10^{n+1}}{1.5 \times 10^n} = 16 \times 10^{n+1-n}$$
$$= 16 \times 10$$
$$= 1.6 \times 10^2$$

Answer ..... 1.6×10^2 ..... [2]

---

10 A group of 25 students each complete a puzzle.
The table shows information about the times, in minutes, the students took to complete the puzzle.

mid – value	15	22.5	27.5	35	55
time (t minutes)	$10 < t \leqslant 20$	$20 < t \leqslant 25$	$25 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 70$
frequency	1	2	8	7	7

(a) Calculate an estimate for the mean time.

$$\frac{(15 \times 1) + (22.5 \times 2) + (27.5 \times 8) + (35 \times 7) + (55 \times 7)}{25}$$

$= 36.4$

Answer ..... 36.4 ..... minutes [1]

(b) Lihui attempted the puzzle later than the group.
She took 39 minutes to complete the puzzle.
Her time is added to the table.

Without doing any further calculations, decide whether the estimated mean will increase or decrease.
Give a reason for your answer.

Decrease ..... because ..... Lihui's time would be categorised under $30 < t \leqslant 40$, and since the mid-value of 35 would be added to the total time for 26 students, the new estimated mean would decrease from the current value of 36.4 mins. ..... [1]

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11 Brian, Amal and Priya share some money.

The ratio Brian's share : Amal's share is 3 : 4.
The ratio Brian's share : Priya's share is 4 : 7.

Priya receives $150 more than Amal.

Find how much Brian receives.

The ratio Brian's share : Amal's share is 3 : 4 = 12 : 16 (when multiplied by 4)

The ratio Brian's share : Priya's share is 4 : 7 = 12 : 21 (when multiplied by 3)

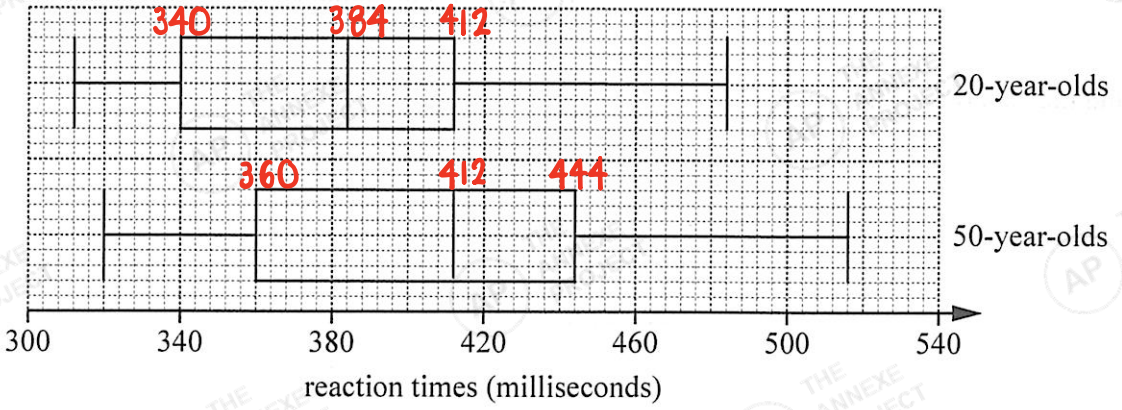
Hence, the ratio of Brian : Amal : Priya = 12 : 16 : 21

21 − 16 = 5 units
5 units = $150
1 unit = $ 30
12 units = 12 × $30 = $360 (Brian's share)

Answer $ 360 [3]

---

12 A group of 20-year-olds and a group of 50-year-olds had their reaction times, in milliseconds, tested. The box-and-whisker plots show the distributions of their times.



Make **two** comments comparing the reaction times of the two groups.
Use figures to support your answers.

1 The 20-year-olds have a shorter reaction time if we compare their median time. (20-year-olds' median time is 384 ms, while the 50-year-olds' median time is 412 ms).

2 The 20-year-olds' reaction times are more consistent because their interquartile range (IQR) is 412 − 340 = 72 ms, while the 50-year-olds' IQR is 444 − 360 = 84 ms.

[3]

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13 Find all the integers that satisfy the inequalities $21 < 5 - 4x \leqslant 47$.

$21 - 5 < -4x \leqslant 47 - 5$

$16 < -4x \leqslant 42$

Divide all by -4:

$-4 > x \geqslant -10.5$

$\therefore -10.5 \leqslant x < -4$

Answer Integers : $-10, -9, -8, -7, -6, -5$ [3]

---

14 F is the point $(-3, -4)$, G is the point $(5, -14)$ and $\overrightarrow{GH} = \begin{pmatrix} -8 \\ 20 \end{pmatrix}$.

(a) Find the coordinates of H.

$\overrightarrow{GH} = \overrightarrow{OH} - \overrightarrow{OG}$

$\overrightarrow{OH} = \overrightarrow{GH} + \overrightarrow{OG}$

$= \begin{pmatrix} -8 \\ 20 \end{pmatrix} + \begin{pmatrix} 5 \\ -14 \end{pmatrix} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$

Answer (−3, 6) [1]

(b) Find the equation of the line GH.

gradient $GH = \frac{6 - (-14)}{-3 - 5}$

$= \frac{20}{-8}$

$= -\frac{5}{2}$

Equation of line GH: $y - (-14) = -\frac{5}{2}(x - 5)$

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

Answer $y = -\frac{5}{2}x - \frac{3}{2}$ [3]

(c) Calculate the length of the line FG.

$\sqrt{(5 - (-3))^2 + (-14 - (-4))^2}$

$= \sqrt{8^2 + (-10)^2}$

$= \sqrt{164}$

$= 12.8$ units

Answer 12.8 units [2]

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15 Use an algebraic method to solve these simultaneous equations.

$2x + 6y = -13$ —— ①
$3x - 8y = 6$ —— ②

You must show your working.

① × 3 : $6x + 18y = -39$ —— ③

② × 2 : $6x - 16y = 12$ —— ④

③ − ④ : $34y = -51$

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

Sub $y = -\frac{3}{2}$ into ① : $2x + 6\left(-\frac{3}{2}\right) = -13$

$2x = -4$

$x = -2$

Answer $x =$ −2 ..... $y =$ $-\frac{3}{2}$ ..... [3]

---

16 Write as a single fraction in its simplest form $\frac{3c}{(2c-3)^2} + \frac{4}{2c-3}$.

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

$= \frac{11c - 12}{(2c-3)^2}$

Answer $\frac{11c - 12}{(2c-3)^2}$ ..... [2]

---

17 Rani is on holiday in the UK.
She spends £86 on her credit card.
The bank charges her account $141.56 which includes a 2.75% fee for the currency conversion.

Calculate the exchange rate used by the bank.
Give your answer in UK pounds per Singapore dollar.

102.75% = $141.56

100% = $\frac{141.56}{102.75} \times 100 = \$137.77$

Hence $137.77 = £86

$\$1 = \frac{86}{137.77} = £0.624$

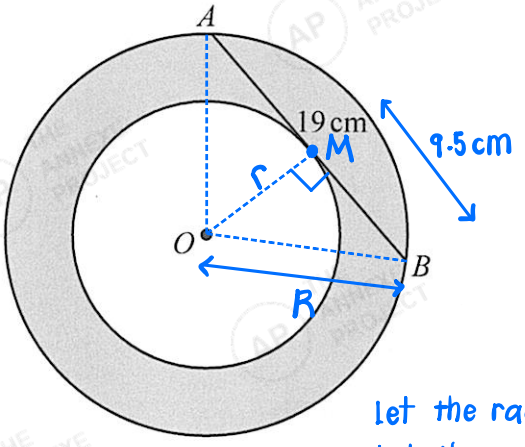
Answer $1 = £ 0.624 ..... [3]

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18 The diagram shows two circles centred at O.



Let the radius of the larger circle be R, i.e. $OA = OB = R$.
Let the radius of the smaller circle be r, i.e. $OM = r$.

AB is a chord of the larger circle and a tangent to the smaller circle.
The length of AB is 19 cm.

Calculate the shaded area.

$R^2 = r^2 + 9.5^2$

$R^2 - r^2 = 9.5^2$

Shaded Area = Area of larger circle − Area of smaller circle

$= \pi R^2 - \pi r^2$

$= \pi (R^2 - r^2)$

$= \pi (9.5^2)$

$= 283.53$

$= 284$

Answer ..... 284 ..... cm^2 [2]

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19 (a) A box contains blue marbles, yellow marbles and pink marbles.
The probability of picking a pink marble at random is 0.37 .

Find the probability of picking a blue or yellow marble at random.

$1 - 0.37 = 0.63$

Answer 0.63 [1]

(b) A bag contains 20 counters.
10 of the counters are red, 6 are white and 4 are green.
Three counters are picked at random from the bag.

Find the probability that exactly two of the counters are red.

{R, R, white or green} + {R, white or green, R} + {white or green, R, R}

$= \left(\frac{10}{20} \times \frac{9}{19} \times \frac{10}{18}\right) \times 3$

$= \frac{15}{38}$

Answer $\frac{15}{38}$ [2]

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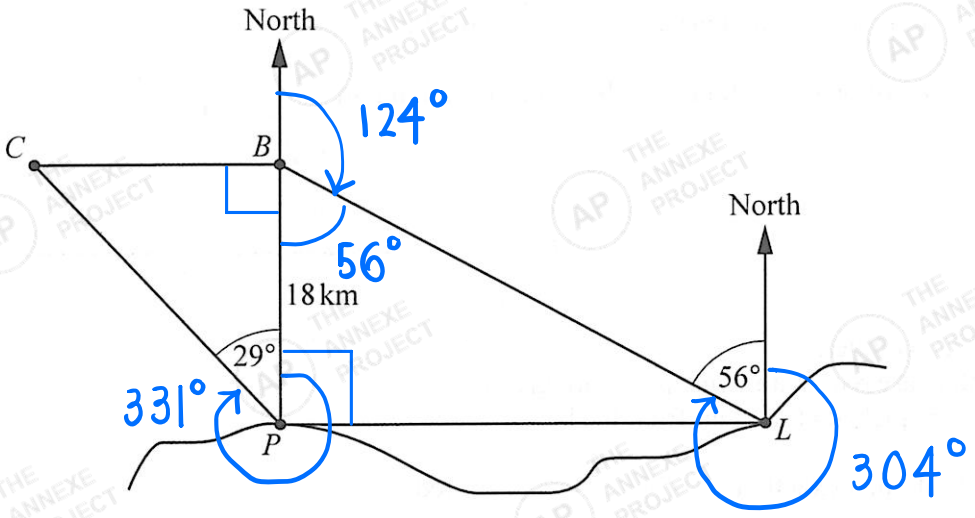
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The diagram shows the positions of a port, P, a lighthouse, L, and two ships, B and C.
B is 18 km due north of the port, and B is on a bearing of 304° from the lighthouse.
C is due west of B, and C is on a bearing of 331° from the port.
The lighthouse is due east of the port.

(a) Write down the bearing of L from B.

$180° - 56° = 124°$ (int. $\angle$s)

Answer 124° [1]

(b) Calculate the distance PL.

$\angle PBL = 180° - 124° = 56°$ ($\angle$s on a str. line)
since $\triangle BPL$ is right-angled,
$\tan 56° = \frac{PL}{18}$
$PL = 18 \times \tan 56°$
$= 26.686$

Answer $PL =$ 26.7 km [2]

(c) Calculate the distance PC.

$\cos 29° = \frac{18}{PC}$
$PC = \frac{18}{\cos 29°} = 20.580$

Answer $PC =$ 20.6 km [2]

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21 Simplify $\dfrac{(3x-2)^2-(x-3)^2}{4x^2-8x-5}$.

$$\frac{(3x-2)^2-(x-3)^2}{4x^2-8x-5} = \frac{(3x-2+x-3)(3x-2-x+3)}{(2x-5)(2x+1)}$$

$$= \frac{(4x-5)(2x+1)}{(2x-5)(2x+1)}$$

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

$2x$	×	-5	$-10x$
$2x$		1	$+2x$
$4x^2$		-5	$-8x$

Answer $\dfrac{4x-5}{2x-5}$ [3]

---

22 Solve.

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

$$\frac{(2x+5)(3x-1)-3(2x^2-1)}{3(3x-1)} = 1$$

$$\frac{6x^2+13x-5-6x^2+3}{3(3x-1)} = 1$$

$$13x-2 = 3(3x-1)$$

$$13x-2 = 9x-3$$

$$4x = -1$$

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

Answer $x =$ $-\dfrac{1}{4}$ [3]

---

23 Write $\left(\dfrac{27x^6y^{-3}}{z^9}\right)^{-\frac{4}{3}}$ in the form $ax^py^qz^r$ where a, p, q and r are constants.

$$\left(\frac{27x^6y^{-3}}{z^9}\right)^{-\frac{4}{3}} = \frac{(3^3)^{-\frac{4}{3}}(x^6)^{-\frac{4}{3}}(y^{-3})^{-\frac{4}{3}}}{(z^9)^{-\frac{4}{3}}}$$

$$= \frac{3^{-4}x^{-8}y^4}{z^{-12}}$$

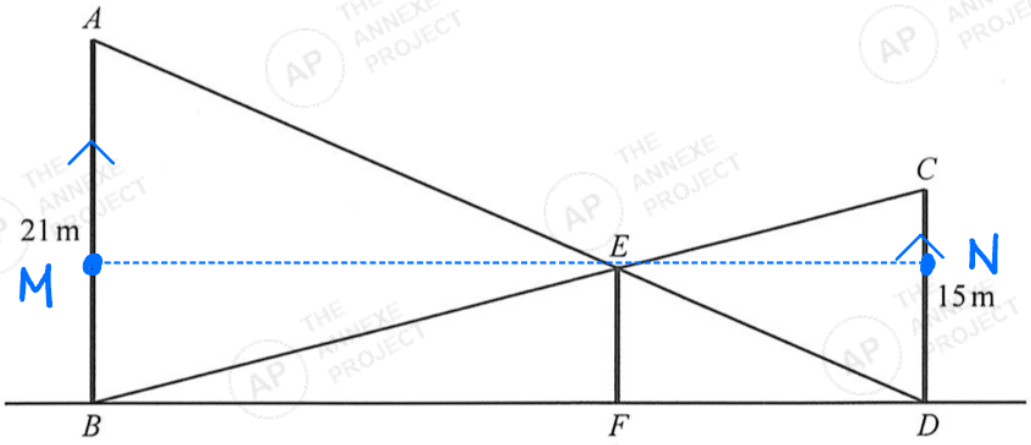
$$= \frac{1}{81}x^{-8}y^4z^{12}$$

where $a=\frac{1}{81}$, $p=-8$, $q=4$, $r=12$ *Answer* $\dfrac{1}{81}x^{-8}y^4z^{12}$ [3]

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24



The diagram shows three vertical posts, AB, CD and EF, which are built in a straight line with points B, D and F on horizontal ground.
The height of AB is 21 m and the height of CD is 15 m.
AED and BEC are straight lines.

(a) Show that triangle ABE and triangle DCE are similar.
Give a reason for each statement you make.

A ⟷ D
B ⟷ C
E ⟷ E

• ∠ABE = ∠DCE (alt. ∠s, AB // CD)
• ∠AEB = ∠DEC (vert. opp. ∠s, AED and BEC are straight lines)

[2]

(b) Calculate the height of EF.

Since △ABE is similar to △DCE,

$$\frac{AB}{DC} = \frac{BE}{CE}$$

$$\frac{21}{15} = \frac{BE}{CE}$$

$$\therefore \frac{BE}{CE} = \frac{7}{5}$$

Let MEN be parallel to BFD

△MEB is also similar to △NEC

$$\frac{MB}{NC} = \frac{BE}{CE} = \frac{7}{5}$$

i.e. $\frac{EF}{NC} = \frac{7}{5}$ (because MB = EF)

hence 12 units = 15 m

1 unit = $\frac{15}{12} = \frac{5}{4}$

7 units = $\frac{5}{4} \times 7 = 8.75$ m

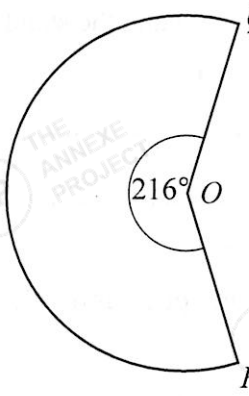
Answer $EF =$ 8.75 m [3]

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25 OPQ is a major sector of a circle, centre O.



The angle of the major sector is 216° and the length of the major arc is 18π cm.

(a) Find the radius of the major sector.

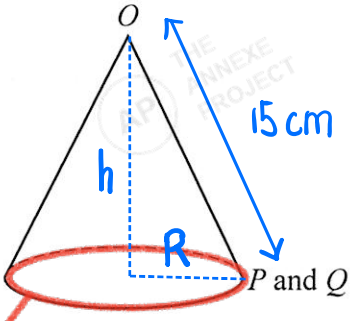
$18\pi = \frac{216°}{360°} \times 2\pi r$

$18 = 1.2r$

$r = \frac{18}{1.2} = 15$

Answer 15 cm [2]

(b) The major sector is formed into a cone by joining the two radii, OP and OQ, together.



Calculate the volume of the cone.

the circumference of this circle = 18π

Let R be the base radius of the cone.

$18\pi = 2\pi R$

$R = 9$ cm

$h^2 + 9^2 = 15^2$

$h = \sqrt{15^2 - 9^2} = 12$ cm

$\therefore V = \frac{1}{3}\pi R^2 h$

$= \frac{\pi}{3} \times 9^2 \times 12 = 324\pi$

$= 1017.88$

Answer 1020 (3 s.f.) cm^3 [4]

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26 A set of 25 numbers has a mean of 30 and a standard deviation of 10.

Explain how every number in the set must be changed so that the mean becomes 75 and the standard deviation becomes 20.

If every number in the set is doubled, the new mean becomes 60 and the standard deviation is also doubled to become 20. Then we add 15 to every number in the set. This increases the mean by 15, with no change to the standard deviation. [1]

27 The frequency, f Hz, of a musical note produced by a string is proportional to the square root of the tension, T newtons, in the string.

The tension in a string is increased so that there is a 100% increase in the frequency.

Calculate the percentage increase in the tension.

Step 1: $f = k\sqrt{T} \longrightarrow f^2 = k^2 T$

Step 2: let f increase from a to $2a$

initially, $a^2 = k^2 T_i$

$T_i = \frac{a^2}{k^2}$

now, $(2a)^2 = k^2 T_n$

$4a^2 = k^2 T_n$

$T_n = \frac{4a^2}{k^2} = 4T_i$

where T_i = initial tension

T_n = tension now

$\therefore \frac{4T_i - T_i}{T_i} \times 100\% = 300\%$

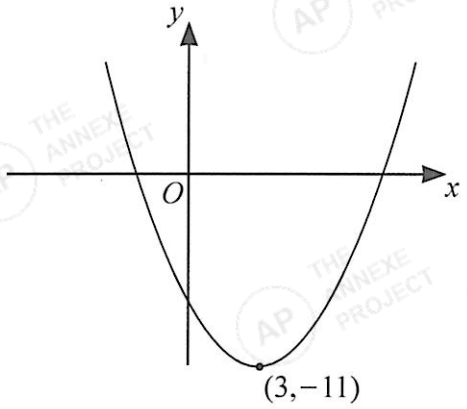
Answer 300 % [3]

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28 The diagram shows the graph of $y = x^2 + bx + c$ where b and c are integers.



The curve has a minimum point at (3, −11).

Find the value of b and the value of c.

Step 1: Complete the square

$y = \left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$

Step 2: Let $x + \frac{b}{2} = 0$

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

$\therefore -\frac{b}{2} = 3$

$b = -6$

Step 3: $-\left(\frac{b}{2}\right)^2 + c = -11$

$-\left(\frac{-6}{2}\right)^2 + c = -11$

$c = -11 + 9$

$= -2$

Answer $b =$ ..−6.. $c =$ ..−2.. [3]

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