Cambridge Assessment International Education

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6180184614

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π, use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

DC (LK/CB) 200398/2

1 **(a)** **(i)** Yasmin and Zak share an amount of money in the ratio 21 : 19.
Yasmin receives $6 more than Zak.

Calculate the total amount of money shared by Yasmin and Zak.

Ratio 21:19
Let what Zak receives be x
Yasmin recives $x+6$.
$21-19=2$
$\frac{2x}{2}=\frac{6}{2}$ $x=\underline{\underline{3}}$

Total ratio = 40
40×3
$=\underline{\underline{120}}$

$ ......120...... [2]

(ii) In a sale, all prices are reduced by 15%.

(a) Yasmin buys a blouse with an original price of $40.

Calculate the sale price of the blouse.

Original Prices = 100%
Sale price = 100% − 15%
= $\underline{\underline{85\%}}$
$40 → 100%
? − 85%

$\frac{40\times85}{100}=\underline{\underline{34}}$

$ ......34...... [2]

(b) Zak buys a shirt with a sale price of $29.75 .

Calculate the original price of the shirt.

Sale Price = (100% − 15%)
= 85%
85% is equivalent to 29.75
100% ——— ?.

$\frac{100\times29.75}{85}=\underline{\underline{35}}$

$ ......35...... [2]

(b) Xavier's salary increases by 2% each year.
In 2010, his salary was \$40 100.

(i) Calculate his salary in 2015.
Give your answer correct to the nearest dollar.

Increase 2% each year.
From 2010 – 2015 = 5 years.

$A = P(1 + r/100)^n$

$= 40,100(1 + 2/100)^5$

$= 40,100(1.02)^5$

$= 44273.64$

$= 44273.64$ (nearest dollar)

\$ 44,274 [3]

(ii) In which year is Xavier's salary first greater than \$47 500?

$\cancel{47500} = \frac{40,100(1 + 2/100)^t}{47500}$

$\frac{47500}{40100} = (1.02)^n$

$\frac{475}{401} = (1.02)^n$

$\log \frac{475}{401} = n \log(1.02)$

$n = \frac{\log 475/401}{\log 1.02}$

$n = 8.55206$

$n \approx 8.55$

$n = 9$ yrs

$2010 + 9 = 2019$

2019 [3]

(c) In January 2020, the population of a town was 5% **more** than its population in January 2018.
In January 2021, the population of this town was 2% **less** than its population in January 2020.

Calculate the overall percentage increase in the population from January 2018 to January 2021.

in year 2018 Population = 100%

in year 2020 Population (5% + 100%) = 105%

in year 2021 Population = 105

$\frac{2}{100} \times 105 = 2.1$

Population = 105 – 2.1 = 102.9

= 102.9

Percentage change = $\frac{2.9}{100} \times 100$

= 2.9%

2.9 % [2]

2 **(a)** $y = px^2 + t$

(i) Find the value of y when $p = 3$, $x = 2$ and $t = -13$.

Substitute value of P, x and t.

$y = Px^2 + t$

$= 3(2^2) + -13$

$= 3 \times 4 \quad 12 + -13 = \underline{-1}$

$y =$ .... -1 .... [2]

(ii) Rearrange the formula to write x in terms of p, t and y.

$y = Px^2 + t$

$\frac{y - t}{p} = \frac{px^2}{p}$

$x^2 = \frac{y-t}{p}$

$x = \sqrt{\frac{y-t}{p}}$

$x =$ .... $\sqrt{\frac{y-t}{p}}$ .... [3]

(b) **(i)** Factorise.

$15x^2 - 2x - 8$

Using quadratic expression ax^2+bx+c

Product $= a \times c = 15 \times -8$

$= -120 \begin{pmatrix}-12\\10\end{pmatrix}$

Cofficient $b =$ Sum $\quad -2$

$15x^2 - 12x + 10x - 8$

$3x(5x - 4) + 2(5x - 4)$

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

.... $(5x-4)\ (3x+2)$ .... [2]

(ii) Solve the equation.

$15x^2 - 2x - 8 = 0$

$(5x-4)(3x+2) = 0$

$5x - 4 = 0$

$\frac{5x}{5} = \frac{4}{5} \quad x = 4/5$

$3x + 2 = 0$

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

$x =$ .... $4/5$ .... or $x =$ .... $-2/3$ .... [1]

(c) Factorise completely.

$x^3 - 16xy^2$

Common factor is x.

$x^3 - 16xy^2$

$x(x^2 - 16y^2)$

difference of two squares.

$x^2 - 16y^2$

$\underline{(x-4y) + (x+4y)}$

$\underline{x[(x-4y)(x+4y)]}$

.... $x[(x-4y)(x+4y)]$ .... [3]

(d) Simplify. $\dfrac{2x-1-4ax+2a}{2x^2-x}$

Considering Common factors.

$$\frac{1(2x-1)-2a(2x-1)}{x(2x-1)}$$

$$\frac{\cancel{(2x-1)}(1-2a)}{x\cancel{(2x-1)}}$$

$$=\frac{1-2a}{x}$$

$\frac{1-2a}{x}$ .... [4]

3 **(a)** Zoe's test scores last term were 6 7 7 7 8 9 9 10 10.

Find

(i) the range, = Highest Value − Smallest Value

= 10 − 6

= $\underline{4}$

4 [1]

(ii) the mode, Most Common number.

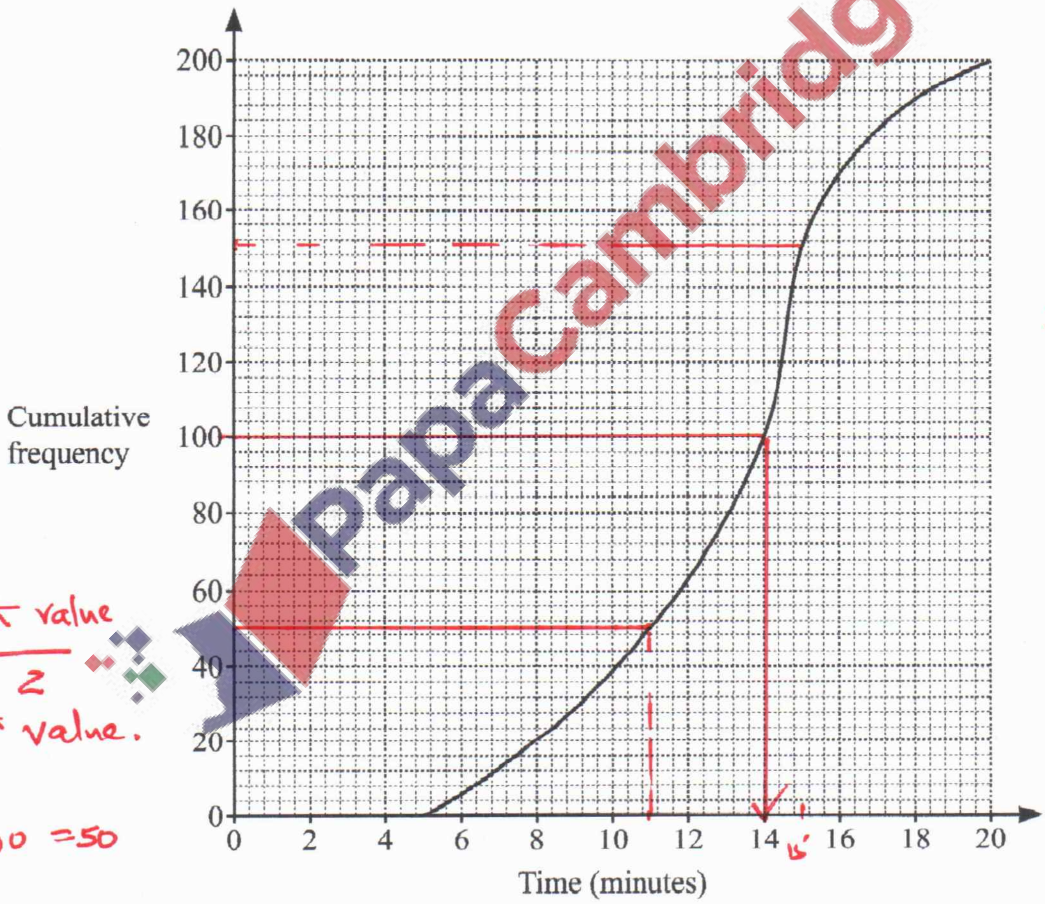
7 [1]

(iii) the median. Middle value in data.

~~6~~, ~~7~~, ~~7~~, ~~7~~, 8, ~~9~~, ~~9~~, ~~10~~, ~~10~~

8 [1]

(b) The cumulative frequency diagram shows information about the time taken by each of 200 students to solve a problem.



$\frac{3}{4} \times 200$

$= 150$

Median = $\frac{\text{Nth value}}{2}$

100th value.

Lower Quartile = $\frac{1}{4} \times 200 = 50$

Use the diagram to find an estimate of

(i) the median,

Median = $\underline{\underline{14}}$

14 min [1]

(ii) the interquartile range.

Interquartile range = upper quartile − lower quartile

= 15 − 11

= $\underline{4}$

4 min [2]

(c) The test scores of 200 students are shown in the table.

Score	5	6	7	8	9	10
Frequency	3	10	43	75	48	21

Calculate the mean.

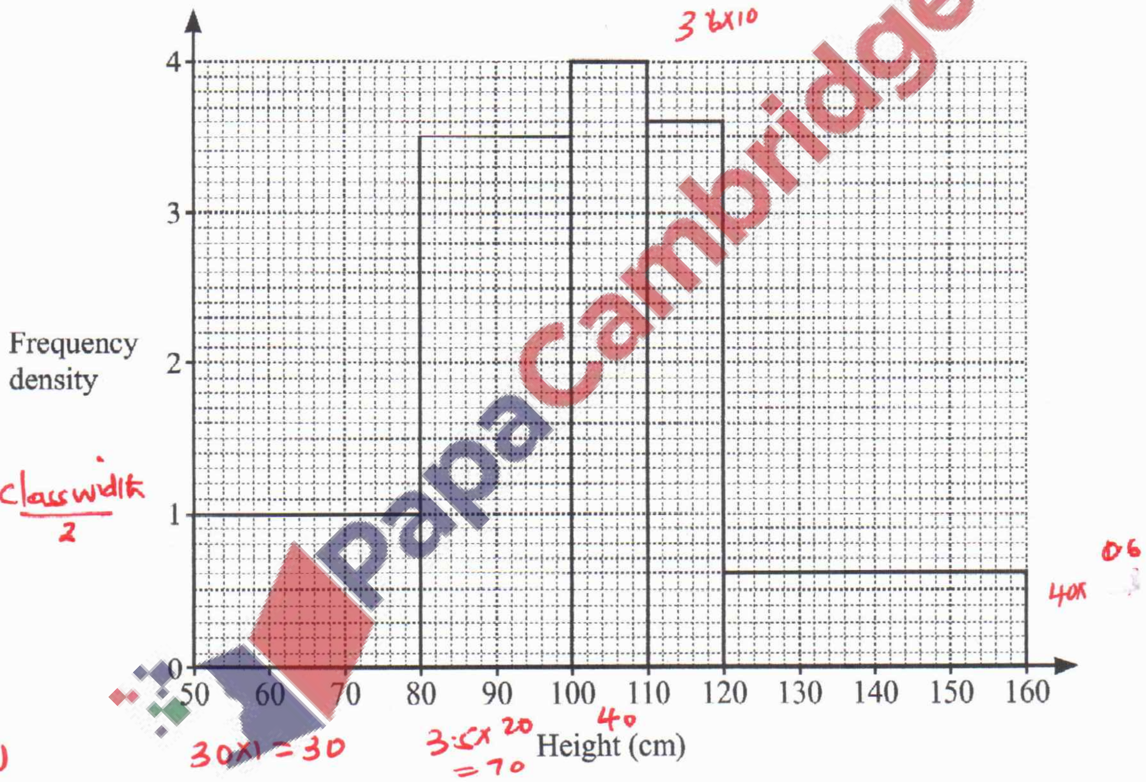
$$\text{Mean} = \frac{(5\times3)+(6\times10)+(7\times43)+(8\times75)+(9\times48)+(10\times21)}{200}$$

$$= 15 + 60 + 301 + 600 + 432 + 210$$

$$\frac{1618}{200} = 8.09$$

8.09 .... [3]

(d) The height, in cm, of each of 200 plants is measured.
The histogram shows the results.



Midpoint = $\frac{\text{classwidth}}{2}$

$F.d = \frac{F}{c.w}$

Calculate an estimate of the mean height.
You must show all your working.

Frequency = F.D x C.W

Height	F	Midpoint	fx
50 – 80	30	65	1950
80 – 100	70	90	6300
100 – 110	40	105	4200
110 – 120	36	115	4140
120 – 160	24	140	3360
	$\Sigma f = 200$		$\Sigma fx = 19950$

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{19950}{200}$$

$$= 99.75$$

99.75 .... cm [6]

4 **(a)** A is the point $(1, 5)$ and B is the point $(3, 9)$.
M is the midpoint of AB.

(i) Find the coordinates of M.

Midpoint $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$= \left(\frac{1+3}{2}, \frac{9+5}{2}\right)$

$\left(\frac{4}{2}, \frac{14}{2}\right)$

$(2, 7)$

(2 , 7) [2]

(ii) Find the equation of the line that is perpendicular to AB and passes through M.
Give your answer in the form $y = mx + c$.

Gradient of the line $= \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{9-5}{3-1}$

$= \frac{4}{2}$

$= 2$

For perpendicular lines $m_1 \times m_2 = -1$

$2 \times -\frac{1}{2} = -1$

$m_2 = -\frac{1}{2}$

$(2, 7)$ (x, y) $m = -\frac{1}{2}$

$\frac{y-7}{x-2} = -\frac{1}{2}$

$2(y-7) = -1(x-2)$

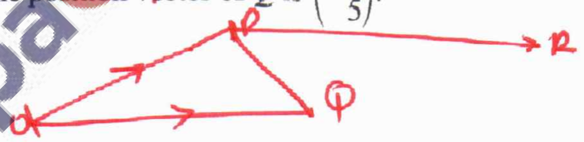
$2y - 14 = -x + 2$

$2y = -x + 2 + 14$

$\frac{2y}{2} = -\frac{x}{2} + \frac{16}{2}$ $y = -\frac{1}{2}x + 8$

$y =$ $-\frac{1}{2}x + 8$ [4]

(b) The position vector of P is $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and the position vector of Q is $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$.



(i) Find the vector $\overrightarrow{PQ}$.

$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OP}$

$= \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -2 \\ 5 \end{pmatrix}$

$= \begin{pmatrix} 0 \\ 2 \end{pmatrix}$

$\begin{pmatrix} 0 \\ 2 \end{pmatrix}$ [2]

(ii) R is the point such that $\overrightarrow{PR} = 3\overrightarrow{PQ}$.

Find the position vector of R.

$PR = \begin{pmatrix} x \\ y \end{pmatrix}$

$3\begin{pmatrix} 0 \\ 2 \end{pmatrix}$

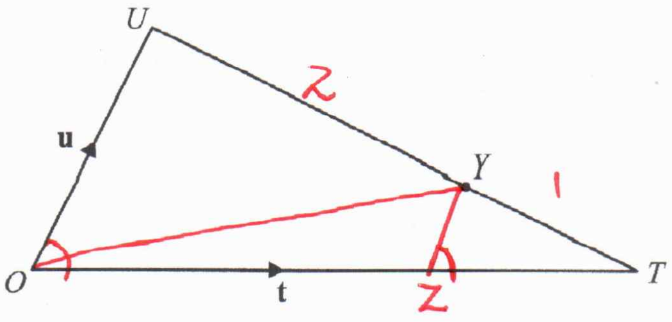
$= \begin{pmatrix} 0 \\ 6 \end{pmatrix}$

$\overrightarrow{OR} = \overrightarrow{OP} + \overrightarrow{PR}$

$\begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 0 \\ 6 \end{pmatrix}$ $= \begin{pmatrix} -2 \\ 9 \end{pmatrix}$

$\begin{pmatrix} -2 \\ 9 \end{pmatrix}$ [2]

(c)



NOT TO SCALE

$\overrightarrow{OT} = \mathbf{t}$, $\overrightarrow{OU} = \mathbf{u}$ and $UY = 2YT$.

(i) Find $\overrightarrow{OY}$ in terms of **t** and **u**.
Give your answer in its simplest form.

$\overrightarrow{OY} = \overrightarrow{OU} + \overrightarrow{UY}$

$\overrightarrow{OY} = u + \frac{2}{3}t - \frac{2}{3}u$

$\overrightarrow{OY} = \frac{1}{3}u + \frac{2}{3}t$

$\overrightarrow{UT} = \overrightarrow{UO} + \overrightarrow{OT}$

$-u + t$

$UT = t - u$

$UY = \frac{2}{3}UT$

$= \frac{2}{3}(t-u)$

$= \frac{2}{3}t - \frac{2}{3}u$

$\overrightarrow{OY} =$ $\frac{1}{3}u + \frac{2}{3}t$ .... [2]

(ii) Z is on OT and YZ is parallel to UO.

Find $\overrightarrow{OZ}$ in terms of **t** and/or **u**.
Give your answer in its simplest form.

→ Since OUT and YZT are equal angles, Thus the figures are similar.

$\overrightarrow{UT} = 3YT$ and $\overrightarrow{OT} = 3ZT$

$\overrightarrow{OZ} = \frac{2}{3}OT$

$= \frac{2}{3}t$

$\overrightarrow{OZ} =$ $\frac{2}{3}t$ .... [1]

5 Solve the simultaneous equations.

(a) $x + 2y = 13$
$x + 5y = 22$

Make x subject in equation(i)

$x + 2y = 13$

$x = 13 - 2y$

Substitute x in equation(ii)

$13 - 2y + 5y = 22$

$3y = 22 - 13$

$\frac{3y}{3} = \frac{9}{3}$

$y = 3$

Replace value of y as 3 in

$x = 13 - 2y$

$x = 13 - 2(3)$

$x = 13 - 6$

$x = 7$

$x =$ ......7......

$y =$ ......3...... [2]

(b) $y = 2 - x$
$y = x^2 + 2x + 2$

Equate both values of y.

$2 - x = x^2 + 2x + 2$

$x^2 + 2x + 2 + x - 2 = 0$

$x^2 + 3x = 0$

Factor out x; $x(x + 3) = 0$

$x = 0$ | $x + 3 = 0$, $x = -3$

Substitute values of x in

$y = 2 - x$

$y = 2 - 0$

$y = 2$

$y = 2 - x$

$y = 2 - (-3)$

$y = 2 + 3$

$y = 5$

$x =$ ......0...... $y =$ ......2......

$x =$ ......-3...... $y =$ ......5...... [4]

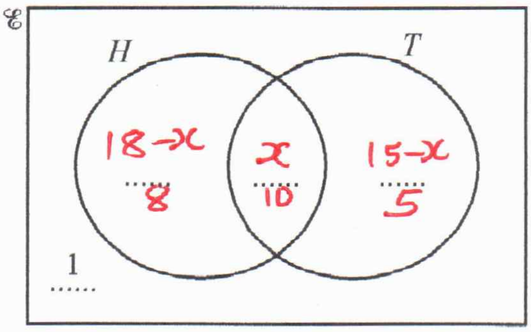
6 In a class of 24 students, 18 students like homework (H), 15 students like tests (T) and 1 student does not like homework and does not like tests.

(a) Complete the Venn diagram to show this information.

$n(H) = 18$

$n(T) = 15$

Let Intersection be x



$18 - \cancel{x} + \cancel{x} + 15 - x = 23$

$33 - x = 23$

$+x = -10$

$x = 10$

[2]

(b) Write down the number of students who like both homework and tests.

Intersection likes both.

........10........ [1]

(c) Find $n(H' \cap T)$.

........5........ [1]

(d) A student is picked at random from the class.

Write down the probability that this student likes tests but does not like homework.

$P(\text{Likes Test}) = \frac{5}{24}$

........$\frac{5}{24}$........ [1]

(e) Two students are picked at random from the class.

Find the probability that both students do not like homework and do not like tests.

P(both don't like Homework and Test)

$= \frac{1}{24} \times \frac{0}{23} = 0$

........0........ [1]

(f) Two of the students who like homework are picked at random.

Find the probability that both students also like tests.

10 like both.

so probability $= \frac{10}{18} \times \frac{9}{17}$

$= \frac{5}{17}$

........$\frac{5}{17}$........ [3]

7 (a)

Values not included

Values are included.

Write down the inequality in x shown by the number line.

$-2 < x$

$x \le 1$

$-2 < x \le 1$ .... [2]

(b) (i) Write $x^2 + 4x + 1$ in the form $(x+p)^2 + q$.

$x^2 + 4x + 1 = x^2 + 2px + p^2 + q$

$\boxed{x^2 + bx + c \quad \left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c}$

$2p\cancel{x} = 4\cancel{x}$

$2p = 4$

$p = \underline{\underline{2}}$

so; $1 = p^2 + q$

$1 = 4 + q$

$q = \underline{\underline{-3}}$

Constants are 1, p^2 and q

so. $\underline{\underline{(x+2)^2 - 3}}$

$(x+2)^2 - 3$ .... [2]

(ii) Use your answer to **part (b)(i)** to solve the equation $x^2 + 4x + 1 = 0$.

$(x+2)^2 - 3 = 0$

$(x+2)^2 = 3$

$(x+2) = \pm\sqrt{3}$

$x = -2 + \sqrt{3} = \underline{\underline{-0.268}}$

$= -2 + 1.732$

$= \underline{\underline{-0.268}}$

$x =$ -0.268 .... or $x =$ -3.73 .... [2]

$x = -2 - \sqrt{3}$ $(-2 - 1.732)$

$= \underline{\underline{-3.73}}$ $= \underline{\underline{-3.73}}$

(iii) Use your answer to **part (b)(i)** to write down the coordinates of the minimum point on the graph of $y = x^2 + 4x + 1$.

For stationary Points $\frac{dy}{dx} = 0$

$y = x^2 + 4x + 1$

$\frac{dy}{dx} = 2x + 4$

$2x + 4 = 0$

$2x = -4$

$x = -2$

When $x = 2$ substitute; y

$y = x^2 + 4x + 1$

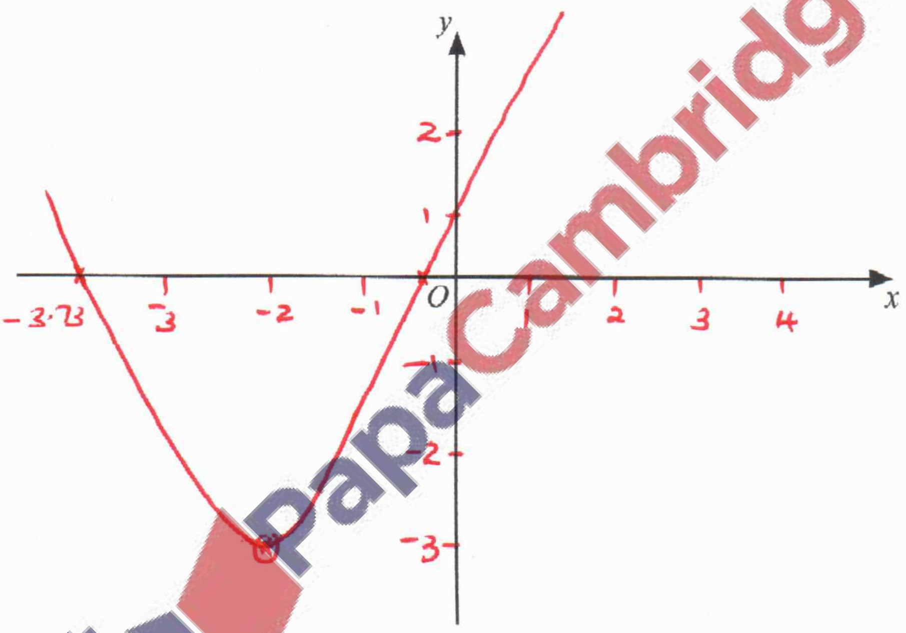
$y = (-2)^2 + 4(-2) + 1$

$y = 4 + -8 + 1$

$y = -3$

(-2 , -3) [2]

(iv) On the diagram, sketch the graph of $y = x^2 + 4x + 1$.



[2]

8 **(a)** A solid cuboid measures 20 cm by 12 cm by 5 cm.

(i) Calculate the volume of the cuboid.

Volume = L x w x h
= 20 x 12 x 5
= 1200 cm3

.......1200 cm³....... cm^3 [1]

(ii) **(a)** Calculate the total surface area of the cuboid.

Total surface are = 2 (Lw + wh + hL)
= 2 (20x12) + (12x5) + (5x20)
= 2 (240) + 60 + 100)
= 2 (400)
= 800 cm²

.......800....... cm^2 [3]

(b) The surface of the cuboid is painted.
The cost of the paint used is $1.52 .

Find the cost to paint 1 cm^2 of the cuboid.
Give your answer in cents.

Cost of Paint = 1.52
800 cm² → 1.52
1 cm³ = ?

$\frac{1.52 \times 1}{800} = (1.9 \times 10^{-3}) \times 100$
= 0.19

.......0.19....... cents [1]

(b) A solid metal cylinder with radius x and height $\frac{9x}{2}$ is melted.
All the metal is used to make a sphere with radius r.

Find r in terms of x.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

Volume of Cylinder = $\pi r^2 h$
= $\pi \times x \times x \times \frac{9x}{2}$

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

$\frac{\cancel{\pi} x^2 \times \frac{9x}{2}}{\cancel{\pi}} = \frac{\frac{4}{3} \cancel{\pi} r^3}{\cancel{\pi}}$

$3 \times x^3 \times \frac{9}{2} = \frac{4}{3} r^3 \cancel{\times 3}$

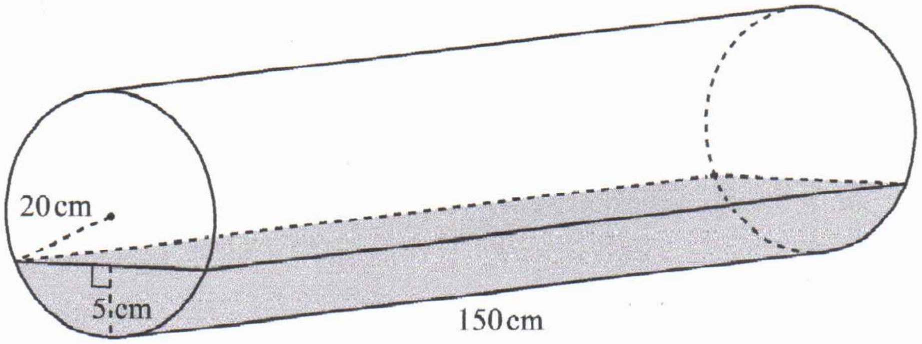
$\frac{\frac{27x^3}{2}}{4} = \frac{\cancel{4} r^3}{\cancel{4}}$

$r^3 = \sqrt[3]{\frac{27x^3}{8}}$

$r = \frac{3}{2}x$ or $1.5x$

$r =$ ....1.5x....... [3]

(c)

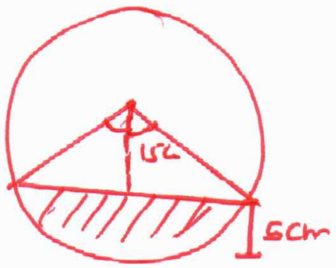


NOT TO SCALE

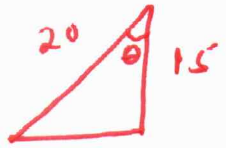
The diagram shows a cylinder of length 150 cm on horizontal ground.
The cylinder has radius 20 cm.
The cylinder contains water to a depth of 5 cm, as shown in the diagram.

Calculate the volume of water in the cylinder.
Give your answer in litres.

Volume of Cross-section x height



Cross-section = Area of Sector − Area of triangle



$\cos\theta = \frac{15}{20}$

$\cos^{-1}\theta = 0.75$

$= (41.4096 \times 2)$

$= \underline{82.82^\circ}$

Area of Sector $= \frac{82.82^\circ}{360} \times \pi \times 20 \times 20$

$= \underline{289.096\text{cm}^2}$

Area of Triangle $= \frac{1}{2}ab\sin C$

$= \frac{1}{2} \times \overset{10}{\cancel{20}} \times 20 \sin 82.82$

$= \underline{198.432\text{cm}^2}$

Area of Cross-section $= 289.096$

$- 198.432$

$= \underline{90.664\text{cm}^2}$

Volume = Area of Crossection x length

$= 90.664 \times 150$

$= \underline{13{,}599.6\text{cm}^3}$

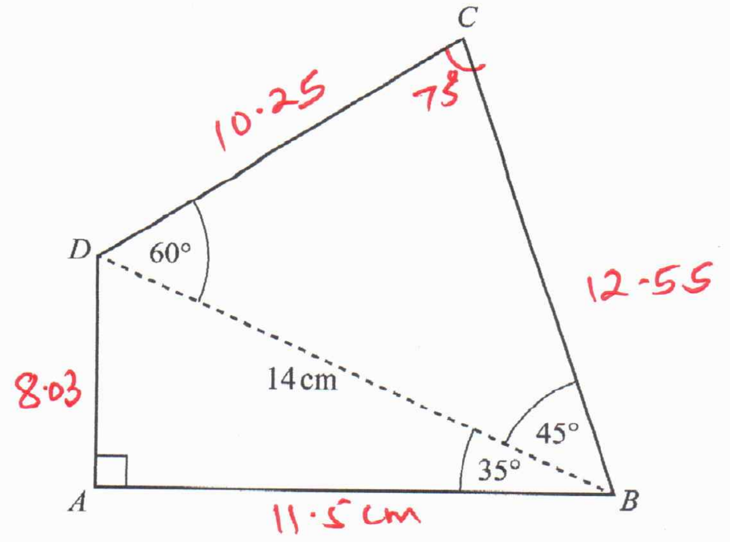
$1\text{cm}^3 = 1\text{ml}$

$1000\text{cm}^3 = 1\text{L}$

$\frac{13{,}599.6}{1000} = \underline{13.5996\text{L}}$

........13.5996........ litres [7]

9 (a)



NOT TO SCALE

Calculate the perimeter of the quadrilateral *ABCD*.

Length of AD =
Using trigonometric ratios AD =

$14\,\cancel{cm} \sin 35^\circ = \frac{AD}{\cancel{14cm}} \times \cancel{14cm}$

$AD = 14 \sin 35$

$AD = \underline{8{\cdot}03}$

$AB = 14 \times \cos 35^\circ = \frac{AB}{\cancel{14cm}} \cancel{\times 14}$

$AB = 11{\cdot}468$

$= \underline{11{\cdot}5cm}$

Since Angles in a triangle sum up to 180°.

$\angle DCB = 180^\circ - (60 + 45^\circ)$

$= 180^\circ - 105^\circ$

$= \underline{75^\circ}$

Using Sine rule length of DC =

$\frac{14cm}{\sin 75^\circ} = \frac{CD}{\sin 45^\circ}$

(Cross Multiply)

$\frac{14 \sin \cancel{45}}{\sin 75} = \frac{CD \cancel{\sin 75}}{\cancel{\sin 75}}$

$CD = \underline{10{\cdot}25cm}$

$\frac{\sin 60^\circ}{BC} = \frac{\sin 45^\circ}{10{\cdot}25}$

$BC = \frac{10{\cdot}25 \sin 60}{\sin 45^\circ}$

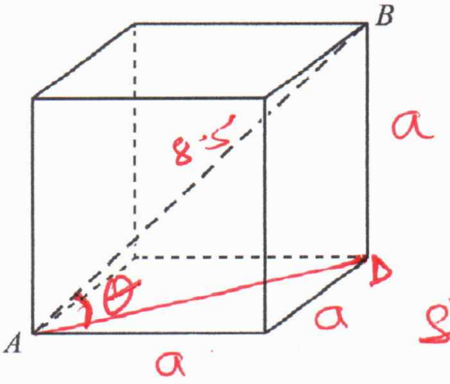
$BC = \underline{12{\cdot}55cm}$

42·33 .... cm [7]

$\text{Perimeter} = 8{\cdot}03 + 11{\cdot}5 + 10{\cdot}25 + 12{\cdot}55$

$= \underline{42{\cdot}33\ CM}$

(b)



Since it is a cube all sides are equal.

The diagram shows a cube.
The length of the diagonal AB is 8.5 cm.

(i) Calculate the length of an edge of the cube.

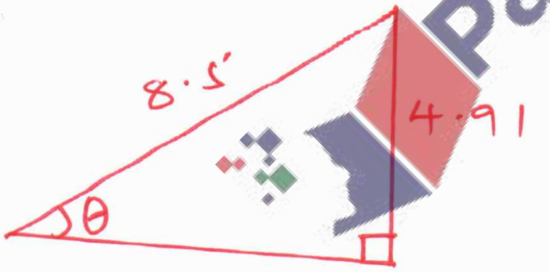
$AD^2 = a^2 + a^2$
$= \underline{\underline{2a^2}}$

$AD^2 + BD^2 = AB^2$
$2a^2 + a^2 = 8.5^2$
$3a^2 = 8.5^2$

$\frac{3a^2}{3} = \frac{72.25}{3}$
$a^2 = \sqrt{24.083}$
$a = 4.9074$
$\simeq \underline{\underline{4.91 \text{ cm}}}$

............4.91............ cm [3]

(ii) Calculate the angle between AB and the base of the cube.



$\sin\theta = \frac{4.91}{8.5}$

$\sin^{-1}\theta = 0.5776$
$\simeq 35.28$
$= \underline{\underline{35.3^\circ}}$

............35.3°............ [3]

10 $f(x) = 3x - 2$ $g(x) = 5x - 7$ $h(x) = x^2 + x$ $j(x) = 3^x$

(a) Find

(i) f(2),

Substitute $x = 2$

$3(2) - 2$

$6 - 2 = \underline{4}$

.... 4 [1]

(ii) g(2),

$g(2) = 5(2) - 7$

$10 - 7$

$= \underline{3}$

.... 3 [1]

(iii) gf(2).

First do f followed by g.

$f(2) = 4$, so; $g(4) = 5(4) - 7$

$= 20 - 7$

$= \underline{13}$

.... 13 [1]

(b) Find $f^{-1}(x)$.

Write function as y $y = 3x - 2$

replace x with y and y with x $x = 3y - 2$ Make y subject

$\frac{x+2}{3} = \frac{\cancel{3}y}{\cancel{3}}$ $y = \frac{x+2}{3}$

$f^{-1}(x) =$ .... $\frac{x+2}{3}$ [2]

(c) Find hf(x), giving your answer in the form $ax^2 + bx + c$.

$hf(x)$

$f = 3x2$

Expand: $h(3x-2) = (3x-2)^2 + 3x-2$

$(3x-2)(3x-2)$

$3x(3x-2) - 2(3x-2)$

$9x^2 - 6x - 6x + 4$

$9x^2 - 12x + 4$

$9x^2 - 12x + 4 + 3x - 2$

$\underline{9x^2 - 9x + 2}$

.... $9x^2 - 9x + 2$ [3]

(d) Find the derivative of h(x). derivative refers to differeniation

$x^2 + x$

$\frac{dy}{dx} = \underline{2x+1}$

.... $2x+1$ [1]

(e) **(i)** Find x when $j^{-1}(x) = 4$.

$j^{-1}(x) = y = 3^x$.

$x = 3^y$

$x = 3^4$

$x = \underline{81}$

$x =$ .... 81 [1]

(ii) Simplify $j^{-1}j(x)$.

This means the inverse of a number is basically itself.

$j^{-1}j(\ ) = \underline{x}$

.... $\underline{x}$ [1]

11 **(a)** These are the first four terms of a sequence.

$$11 \underset{-4}{\vee} 7 \underset{-4}{\vee} 3 \underset{-4}{\vee} -1 \underset{-4}{\vee}$$

(i) Write down the next term.

$-1-4=-5$

-5 .... [1]

(ii) Write down the term to term rule for this sequence.

It is to subtract 4. .... [1]

(iii) Find the nth term of this sequence.

nth term $= a+(n-1)d$
$= 11+(n-1)-4$
$= 11-4n+4$
$= 15-4n$

$15-4n$ .... [2]

(b) The nth term of a different sequence is $\frac{2n}{n+1}$.

(i) Find the difference between the 5th term and the 6th term of this sequence.
Give your answer as a fraction.

5th term $n=5$ $\frac{2n}{n+1}$ $\frac{2(5)}{5+1}$ $\frac{10}{6}$

Sixth term $n=6$ $\frac{2(6)}{6+1}$ $=\frac{12}{7}$

difference $= \frac{12}{7}-\frac{10}{6}$ $= \frac{72-70}{42} = \frac{2}{42}$ $= \frac{1}{21}$

$\frac{1}{21}$ .... [2]

(ii) Is $\frac{3}{4}$ a term in this sequence?
Show how you decide.

Multiply out $= \frac{3}{4} = \frac{2n}{n+1}$

$3(n+1) = 8n$
$3n+3 = 8n$
$3 = 8n-3n$
$\frac{3}{5} = \frac{5n}{5}$
$n = \frac{3}{5}$

Since it is not an Integer and not greater than 1.

[3]