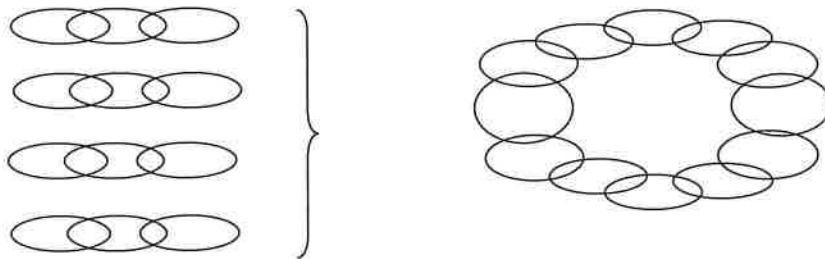


- 1 Represent all prime numbers that lie between $\sqrt{101}$ and $\sqrt[3]{7999}$ on a number line. [2]
- 2 Of the numbers $0.75, \frac{1}{3}, \pi, \sqrt{4}, \sqrt{2}, \frac{4}{11}$, write down
- (a) all the irrational numbers, [1]
- (b) all the numbers that give recurring decimals, [1]
- (c) all the numbers that give terminating decimals. [1]
- 3 Three toy cars go round a track in 39 s, 52 s and 1 min 57 s respectively. If they start from the same point, how much time would have passed before they are side by side again? (Leave your answer in terms of seconds only). [2]
- 4 (a) Evaluate, without the use of calculator, $[(-4) \times (-3)^2 \times 2] \div (-2)$. [2]
- (b) Express $\frac{10}{17}$ as a sum of unlike unit fractions. [2]
- (c) Estimate, correct to one significant figure, the value of $\frac{4.003^2 + \sqrt[3]{64.108}}{\sqrt{15.896}}$. [2]
- 5 (a) Use a calculator to evaluate
- i. $\sqrt[3]{56.12^2 + 23.1^3 - 112 \times 33.5}$,
- ii $\frac{\pi^2 - e^3}{6.23 \div 4 + 8}$
- giving your answer correct to 3 significant places. [2]
- (b) Express $\frac{1}{\frac{30}{0.069}}$ as a fraction in its lowest terms. [2]

- 6 You have four pieces of chain, each of which is made up of three links, all of which are closed. If it costs 2 cents to open a link and 3 cents to close a link, how can you join all twelve links into an unbroken loop without paying more than 15 cents? Explain your answer clearly. [3]



- 7 Simplify the following expressions:

(a) $\frac{a(3a-b)}{a^2} - \frac{5a(4a-b)}{2a^2}$, [3]

(b) $\left(\frac{3pq^2}{r}\right)^2 \div \sqrt{\frac{64p^6}{25q^2}}$. [3]

(c) $\frac{2x}{2x-3} - \frac{6}{9-6x}$ [3]

- 8 Solve

(a) $\frac{4}{2x} + \frac{5}{3x} = 5\frac{1}{2}$, [3]

(b) $\frac{1}{6}(2x+1) - \frac{1}{4}(x-2) = \frac{7}{12}$. [3]

- 9 (a) A factory supervisor agrees to manufacture 1800 mugs in 22 days.

He has a team of 30 workers who work for 8 hours a day. After 10 days, he finds that only 600 mugs were manufactured.

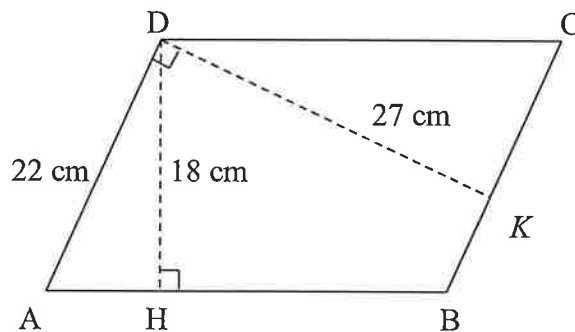
How many more workers should he employ to finish the production on time if each worker now works 10 hours a day? [3]

- (b) A motorist takes 5.75 hrs to travel from P to Q at V km/h. If he increases his speed by 5 km/hr, the time taken will be reduced by half an hour.

By forming and solving an equation in V , find the value of V . [3]

- 10 (a) Convert 0.0000045 km^2 to mm^2 . [1]
 (b) If a car is travelling at a speed of 20 m/s , calculate its speed in km/h . [1]
 (c) Given that n is a positive integer, $n^2 + n$ is always even, do you agree? [2]
 Explain your answer.

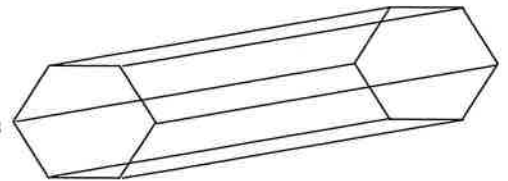
- 11 The diagram shows a parallelogram $ABCD$ where $AD = 22 \text{ cm}$, $DH = 18 \text{ cm}$ and $DK = 27 \text{ cm}$. $\angle DHB = \angle ADK = 90^\circ$. Calculate the perimeter of the parallelogram. [3]



- 12 The diagram shows a solid metal block 1.5 m long with a uniform cross-section in the shape of a regular hexagon of side 3 cm .

Calculate

- (i) its total surface area, [3]
 (ii) its density if the block has a mass of 195 kg . [3]

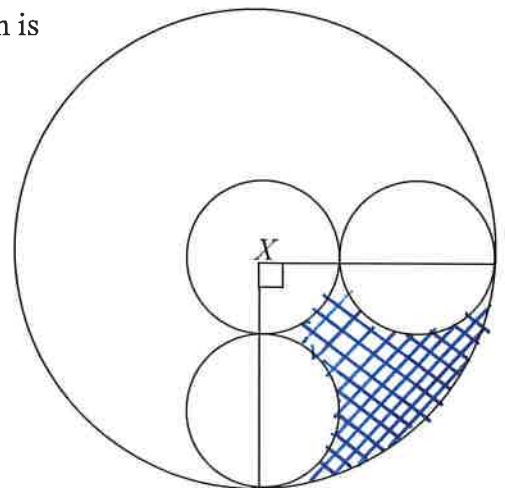


Give your answer in g/cm^3 .

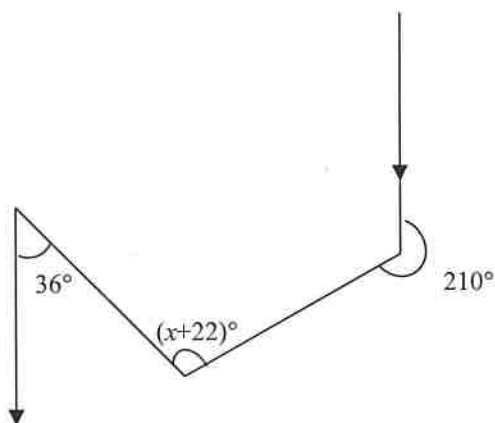
- 13 The diagram shows 3 small circles each of radius $r \text{ cm}$ included in a big circle with centre X . Given that the area of the shaded region is

38.5 cm^2 , find the value of r . (Take $\pi = \frac{22}{7}$)

[3]



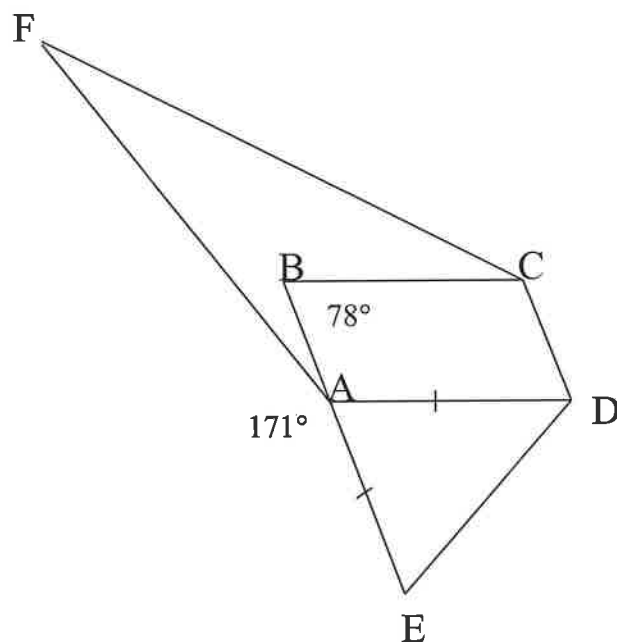
- 14 Calculate the value of x . [2]



- 15 In the diagram not drawn to scale,
 $ABCD$ is a parallelogram. $AD = AE$,
 BAE is a straight line,
 $\angle ABC = 78^\circ$ and $\angle EAF = 171^\circ$.

Calculate (i) $\angle AED$, [1]

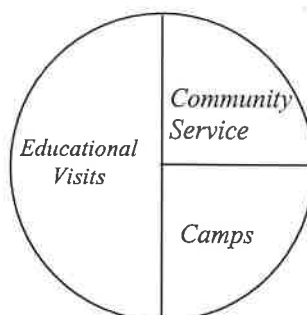
(ii) $\angle FAD$. [2]



- 16 (a) The pie charts below show the amount of time spent for different types of activities in two youth clubs, Club X and Club Y.



Amount of time spent on various types of activities in Club X



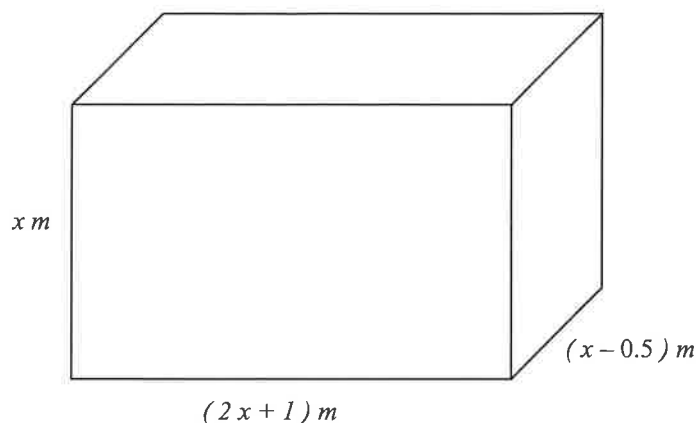
Amount of time spent on various types of activities in Club Y

- (i) JiaLiang, the president of Club X, maintains that by looking at the pie charts, it is evident his club spends more time doing community services than does Club Y. Is this a valid claim? Explain your answer. [2]
- (ii) How would you use a different graphical display to show the above information without bias? [2]
- (b) A shopping survey was conducted to compare wet-market prices across some residential estates. A standard list of items was identified and these same items were bought (same quantity) from each market. The costs of the items from each market obtained were represented in the stem-and-leaf plot as follows:

Stem (\$)	Leaf (¢)			
62	50			
63				
64	10	90		
65	00	00	15	50
66	20	80	90	
67	20			
68				
69				
70				
71				
72	75			

- (i) Find the mean, mode and median of this cost distribution. [3]
- (ii) Which measure of central tendencies best represents this distribution? Explain. [2]

- 17 Joshua wants to keep an aquarium as a hobby. His dad agrees only if he contributes to the family's monthly utilities bills for the amount of water he uses. Joshua wants to have his aquarium of the following dimension:



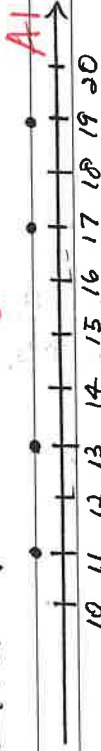
- (a) Write down an expression, in terms of x , for the volume of this aquarium. Do not expand the expression. [1]
- (b) Write down another algebraic expression to represent the amount of water required he needs to fill water up to only 90% of the volume of the aquarium tank. [1]
- (c) Given that $x = 1$, calculate the volume of water used to fill the aquarium to a height of 0.9m. [1]
- (d) The cost of water per cubic metre is \$1.17. If he needs to completely replace the same amount of water in the aquarium four times in a month, how much will it cost him each month? Leave your answer correct to the nearest cent. [2]
- (e) Joshua's Dad reminded him that there is also a waterborne fee of thirty cents per cubic metre of water used, a water conservation tax of 30% on the cost of water used and a Goods & Services Tax of 5% on the total cost incurred. Calculate the total amount of money Joshua has to contribute to the family's monthly utilities bill. Leave your answers correct to the nearest cent. [4]

END OF PAPER

2023 MOCK EXAM

1. $\sqrt{100} < \sqrt{101}$
 $10 < \sqrt{101}$ } MI prime numbers

[2] $\sqrt[3]{7999} < \sqrt[3]{8000} = 20$



2(a) $\pi, \sqrt{2}$ } missing ans - 1M
 (b) $\frac{1}{3}, \frac{4}{11}$ } extra wrong ans - 1M
 (c) $0.75, \sqrt{4}$ } A1

3 $39 = 3 \times 13$ 1 min 37s = 117
 $52 = 2^2 \times 13$ } MI
 $117 = 3^2 \times 13$
 $LCM = 3^2 \times 2^2 \times 13 = 468$

$468s = 7min + 8s$
 468s would have passed. A1

4(a) $[(-4) \times (-3)^2 \times 2] \div (-2)$
 $= [-4 \times 9 \times 2] \div (-2)$ MI
 $= \frac{-72}{-2} = 36$ A1

(b) $\frac{10}{17} - \frac{20}{34} = \frac{17}{34} + \frac{2}{34} + \frac{1}{34} = \frac{1}{2} + \frac{1}{17} + \frac{1}{34}$ A2

Any other possible unit fractions combination

MI 2sf for working

4(c) $\frac{4.0^2 + \sqrt{64}}{\sqrt{16}} = \frac{16 + 4}{4}$
 $= \frac{20}{4}$
 $= 5$ A1

5(a) $22.7 (3sf)$ A1
 (i) $-1.07 (3sf)$ A1

(b) $\frac{1}{30} \div \frac{69}{990}$ MI
 $= \frac{1}{30} \times \frac{990}{69}$
 $= \frac{11}{23}$ A1

6. A

B

C

D

MI

Cut ring 1

Connect chain B & chain C tog 34

Cut ring 2

Connect chain B + C with chain D 34

Cut ring 3

Connect B-C-D tog with ring 3 34

Total 454

A1

MI: Clear explanation

$$7(a) \quad \frac{a(3a-b)}{a^2} - \frac{5a(4a-b)}{2a^2}$$

$$= \frac{6a^2-2ab}{2a^2} - \frac{20a^2-5ab}{2a^2}$$

common denominator

$$= \frac{6a^2-2ab-20a^2+5ab}{2a^2}$$

$$= \frac{-14a^2+3ab}{2a^2}$$

single fraction M1

$$= \frac{-14a+3b}{2a}$$

$$= \frac{-14a+3b}{2a} \quad \text{or} \quad -7 + \frac{3b}{2a}$$

A1

(b)

$$\frac{9p^2q^4}{112} \div \frac{8p^3}{5q}$$

$$= \frac{9p^2q^4}{112} \times \frac{5q}{8p^3}$$

$$= \frac{45q^5}{8p^{12}}$$

A1

(c)

$$\frac{2x}{2x-3} - \frac{6}{9-6x}$$

$$= \frac{-6x}{9-6x} - \frac{6}{9-6x}$$

M1: common denominator

$$= \frac{-6x-6}{9-6x}$$

M1: single fraction

$$= \frac{-2x-2}{3-2x} \quad \text{or} \quad \frac{2x+2}{2x-3}$$

M1: single fraction form.

8(a)

$$\frac{4}{2x} + \frac{5}{3x} = \frac{11}{2}$$

$$\frac{12}{6x} + \frac{10}{6x} = \frac{11}{2}$$

common denominator

$$\frac{22}{6x} = \frac{11}{2}$$

$$\frac{11}{3x} = \frac{11}{2}$$

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

M1: solve

(b)

$$2(2x+1) - 3(x-2) = 7$$

$$4x+2 - 3x+6 = 7$$

$$x+8 = 7$$

$$x = -1$$

M1: Expand

9(a)

mus	workers	hrs	day
1000			

Completed: 600 30 8 10

Aim: 1200 ? 10 12

If 1200 30 8 20

1200 30 10 16

1200 40 10 12

He will need 10 more workers.

A1

(b) $\frac{5.75 \text{ hrs}}{P} \rightarrow V \text{ km/h}$

$(V+5) \text{ km/h}$
time: 5.25 hrs

Note dist travelled is constant

$V \cdot 5.75 = (V+5) \cdot 5.25$
 $5.75V = 5.25V + 26.25$
 $0.5V = 26.25$
 $V = 52.5$

The value of V is 52.5.

(100) $1 \text{ km} = 1000 \text{ m}$
 $= 100000 \text{ cm}$
 $1 \text{ km}^2 = 1000000 \text{ mm}^2$

$600000045 \text{ km}^2 = 4500000 \text{ mm}^2$

(b) $\frac{20 \text{ m}}{8} = \frac{0.02 \text{ km}}{3600 \text{ hr}}$

$= 72 \text{ km/h}$

(c) $n \in \mathbb{Z}^+$

$n^2 + n = n(n+1)$
 If n is odd, $n+1$ is even $\Rightarrow n(n+1)$ even
 If n is even, $n+1$ is odd $\Rightarrow n(n+1)$ even.

11 Area of parallelogram = $22 \times 27 = DC \times 18$
 $\Rightarrow DC = 33$

Perimeter of parallelogram, cm

$(22+33) \times 2 = 110$

12 (i) Area of hexagon, $= \frac{1}{2} \times 3 \times \sqrt{3^2 - 1.5^2} \times 6$
 $= \frac{27\sqrt{3}}{2}$ or 23.38

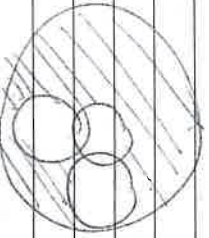
Total surface area, cm^2
 $= \left(\frac{27\sqrt{3}}{2} \right) \times 2 + 3 \times 6 \times 150$
 $= 27\sqrt{3} + 2700$
 $= 2746.8$

≈ 2750 (3sf).

(ii) Vol = $\left(\frac{27\sqrt{3}}{2} \right) \times 150 \text{ cm}^3$
 $= 3507.4 \text{ cm}^3$
 Density = $\frac{195000}{3507.4}$
 $= 55.6 \text{ g/cm}^3$

$D = \frac{m}{V}$

13. Area of shaded region = 38.5 cm^2



$$\pi (3r)^2 - 3\pi r^2 = 38.5$$

$$9\pi r^2 - 3\pi r^2 = 38.5$$

$$6\pi r^2 = 38.5$$

$$r^2 = 38.5 \times \frac{1}{22 \times \frac{1}{6}}$$

$$= \frac{49}{24}$$

$$\frac{1}{24} \pi (3r)^2 - 1.25 \pi r^2 = 38.5$$

$$\frac{9}{4} \pi r^2 - \frac{5}{4} \pi r^2 = 38.5$$

$$\pi r^2 = 38.5 \times \frac{4}{22}$$

$$= \frac{49}{4}$$

$$r = \frac{7}{2} \quad \text{A1}$$

(Alternate Δ s, interior Δ s, Δ s at pt,

$$x + 2x = 36 + 180 - (360 - 210)$$

$$x + 2x = 36 + 180 - 150$$

$$= 36 + 30$$

$$x = 44 \quad \text{A1}$$

15. $\angle DAE = 78^\circ$ (corresponding Δ s)

$$\angle AED = (180^\circ - 78^\circ) \div 2 \text{ of } 2 \text{ isosceles } \Delta$$

$$= 51^\circ \quad \text{A1}$$

$$(ii) \angle FAB = 180^\circ - 171^\circ = 9^\circ \text{ (adj } \Delta \text{ on straight line)}$$

$$\angle FAD = 9^\circ + 102^\circ = 111^\circ \text{ (adj } \Delta \text{ s)}$$

16

(a) N/O. Club X spend a bigger portion of their time in doing commodity services. no X - 1M

However, it is a bigger portion only. It also not show that it is more time we need the total and of time spent to calculate accurately for comparison

(ii) I would compare using bar chart for the number of hours spent. no prep - 1M

(b)

$$(i) \text{ mean } = \frac{\$62.50 + 64.10 + 64.90 + 65.00 + 65.00 + 65.15 + 65.50 + 66.20 + 66.50 + 66.90 + 67.20}{12}$$

$$= \$79200/12$$

$$= \$6600 \quad \text{A1}$$

$$\text{mode} = \$65 \quad \text{A1} \quad \text{mode} = \$65$$

$$\text{median} = \frac{64.4 + 74.4}{2}$$

$$= 65.325$$

$$\approx \$65.33 \text{ (2dp)} \quad \text{A1}$$

16 MI AI

(16) There is a outlier. Hence median is a better rep.

17. Vol = $x(2x+1)(x-0.5) \text{ m}^3$ AI

(b) Amt = $0.9 \times (2x+1)(x-0.5) \text{ m}^3$ AI

(c) Vol = $0.9(3)(0.5) = 1.35 \text{ m}^3$ AI

(d) $4(1.35) \times 1.17 = 6.318$ AI

(2) It will cost him \$6.32 (nearest q) AI

(e) $[6.318 + 0.3(1.35) \times 4 + 0.3(6.318)] \times 1.05$ AI

$= (6.318 + 1.52 + 1.8954) \times 1.05$ AI

$= 9.8334 \times 1.05$ AI

≈ 10.33 AI

Total amt to contribute is \$10.33

