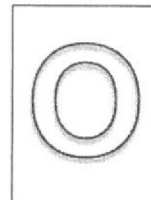




CANBERRA SECONDARY SCHOOL



2021 Preliminary Examination

Secondary Four Express / Five Normal Academic

MATHEMATICS

4048/01

20 August 2021

2 hours

1045 to 1245

Name: _____ () Class: _____

READ THESE INSTRUCTIONS FIRST

Write your full name, class and index number on all work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid or tape.

Answer **all** the 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 number of marks for this paper is 80.

FOR MARKER'S USE		
	Marks Awarded	Max Marks
Total		80

This question paper consists of 22 printed pages including the cover page.

Setter: Mrs Long and Mrs Wee

Mathematical Formulae

Compound interest

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

Mensuration

$$\text{Curved Surface area of a cone} = \pi r l$$

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

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

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

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

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

Trigonometry

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

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

Statistics

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

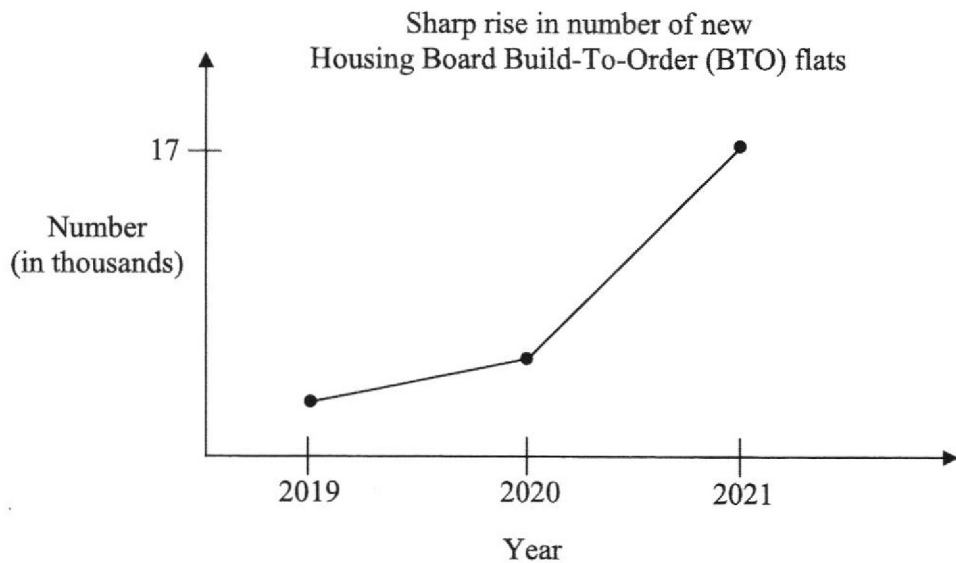
$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

- 1 Elly's height is 1.61 m and Adela's height is 1.73 m, measured correct to three significant figures.

Find the greatest possible difference in their heights in metres, correct to three significant figures.

Answer m [1]

2



Explain how the line graph above may be misleading.

Answer

.....

[1]

- 3 Simplify $(2x^2)^3 \div 4\sqrt{x}$, giving your answer in the form of ax^n , where a and n are rational numbers.

Answer [2]

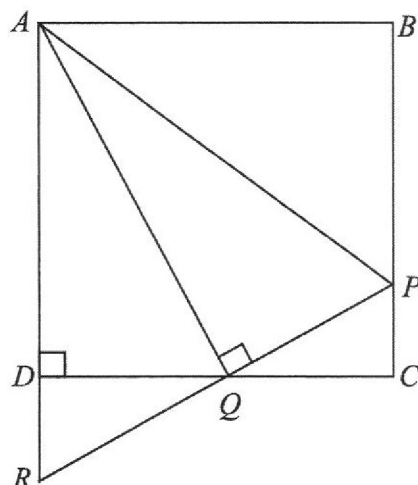
- 4 Given that $9172.05 = (9 \times 10^3) + (1 \times 10^2) + (7 \times 10) + (2 \times 10^a) + (5 \times 10^b)$, write down the values of a and of b .

Answer $a = \dots\dots\dots b = \dots\dots\dots$ [2]

- 5 Write as a single fraction in its simplest form $\frac{3}{1-x^2} - \frac{2}{x+1}$.

Answer [2]

6



$ABCD$ is a square and AQ is perpendicular to PR .

PQR and ADR are straight lines.

$DQ : DC = 1 : 2$.

Show that triangle DQR is congruent to triangle CQP .

Give a reason for each statement you make.

Answer

[2]

- 7 Use **factorisation** to solve the equation.

$$2h^2 - 11h - 21 = 0$$

Answer $h = \dots\dots\dots$ or $\dots\dots\dots$ [2]

- 8 A map is drawn to a scale of $1:n$.
The actual distance between two points X and Y is 2.8 km.
On the map, they are 4 cm apart.

Find the value of n .

Answer $n = \dots\dots\dots$ [2]

- 9 Solve the inequalities $x \leq \frac{x+4}{3} \leq 2x-1$.

Answer [3]

- 10 The acceleration, $a \text{ m/s}^2$, of a particle is inversely proportional to the square of its distance x metres from a fixed point.
The distance of the particle is reduced to $0.5x$.

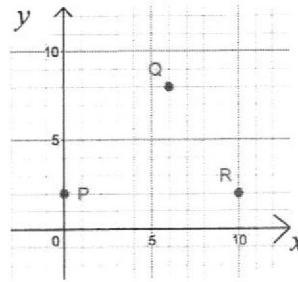
Find the ratio of the acceleration to the original acceleration.

Answer : [3]

- 11 $PQSR$ is a parallelogram.

The coordinates of P , Q and R are $(0,2)$, $(6,8)$ and $(10,2)$ respectively.

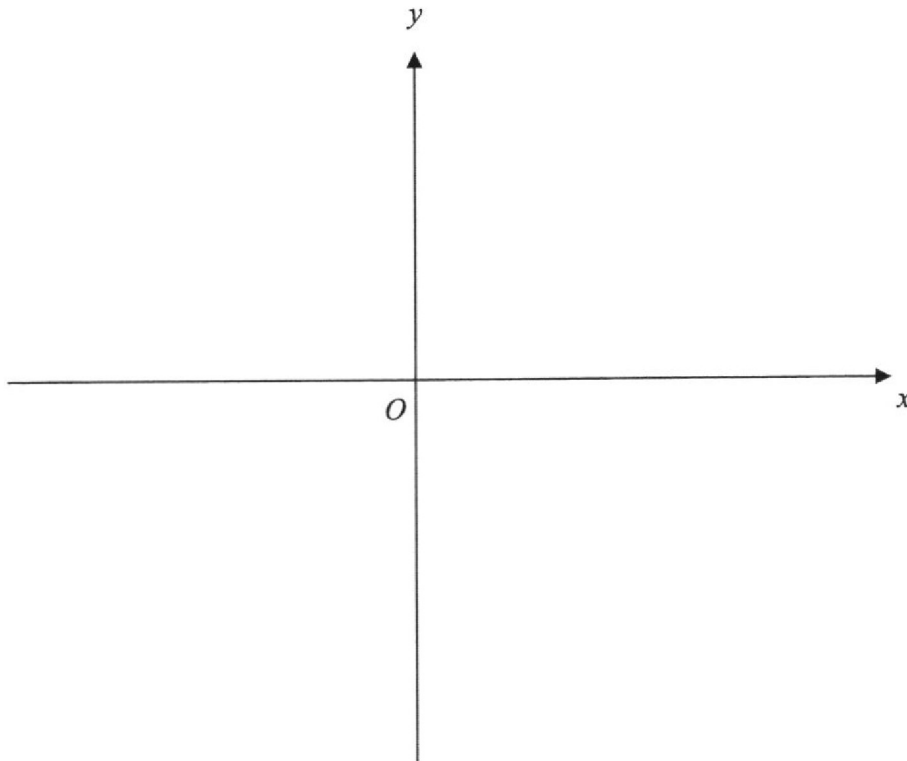
Find area of the parallelogram $PQSR$.



Answer units² [3]

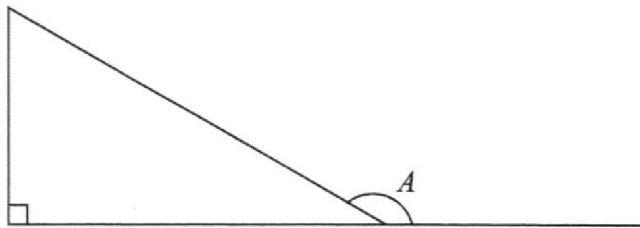
- 12 Sketch the graph of $y = (x+4)(10-x)$ on the axes below.

Indicate clearly the coordinates of the points where the graph crosses the axes and the maximum point on the curve.



[3]

- 13 In the diagram, A is an obtuse angle such that $\sin A = \frac{5}{13}$.



Leaving your answer as a fraction, find the value of

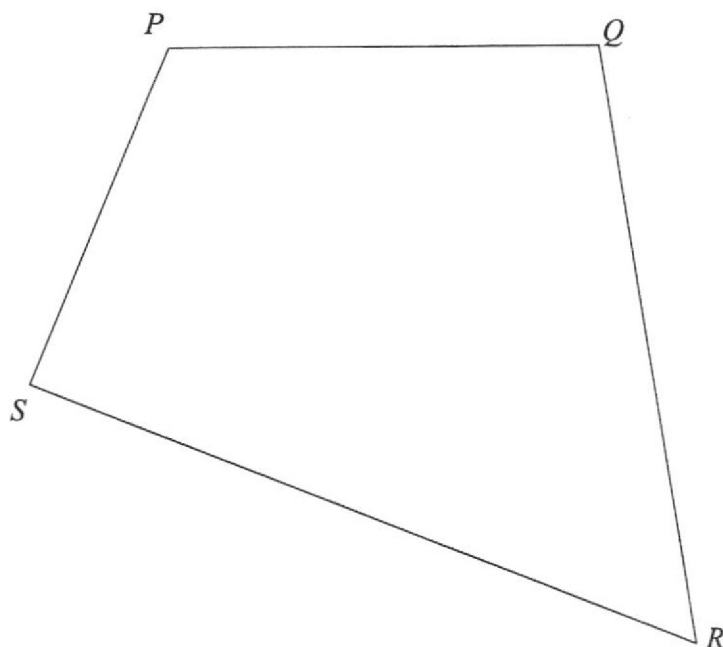
(a) $\sin(180^\circ - A)$,

Answer [1]

(b) $\cos A$.

Answer [2]

- 14 The diagram shows a quadrilateral $PQRS$.



On the diagram,

- (a) construct the perpendicular bisector of SR such that it meets PQ at point Z .
Mark and label Z .
- (b) measure and write down the size of angle PZS .

[2]

Answer° [1]

- 15 (a) Factorise completely $5pr - 2ps - 5qr + 2qs$.

Answer [2]

- (b) Given that $p \neq q$, find the value of $\frac{r}{s}$ when $5pr - 2ps - 5qr + 2qs = 0$.

Answer [2]

- 16 Written as a product of its prime factors,

$$p = 2^1 \times 3^x \times 7^y \text{ and } q = 3 \times 7^2 \times 11$$

- (a) Find the smallest value of x and y for which p is a multiple of 21.

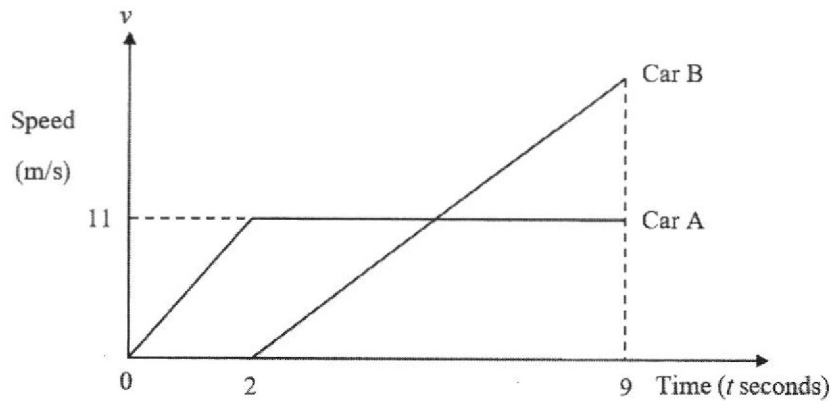
Answer $x = \dots\dots\dots y = \dots\dots\dots$ [2]

- (b) Explain why $33q$ is a perfect square.

Answer

 [2]

17



The diagram shows the speed-time graph of two cars, A and B.
Car A, starting from rest, accelerates uniformly for 2 seconds until it reaches a speed of 11 m/s.

It then continues to travel at constant speed.

2 seconds later, Car B starts from the same point as Car A.

(a) Find

(i) the acceleration of Car A when $t = 1$,

Answer m/s^2 [1]

(ii) the distance travelled by Car A for the first 2 seconds.

Answer m [1]

(b) Car B accelerates uniformly from rest.

It overtakes Car A when $t = 9$ seconds.

Find v , the speed of Car B when it overtakes Car A.

Answer $v =$ [2]

- 18 $\varepsilon = \{ \text{integers } x: 2 \leq x \leq 13 \}$
 $A = \{ \text{prime numbers} \}$
 $B = \{ \text{multiples of } 4 \}$
 $C = \{ \text{factors of } 12 \}$

List the elements in

(a) B' ,

Answer [1]

(b) $A \cap B'$,

Answer [1]

(c) $(A \cup B)'$,

Answer [1]

(d) $B \cap C$.

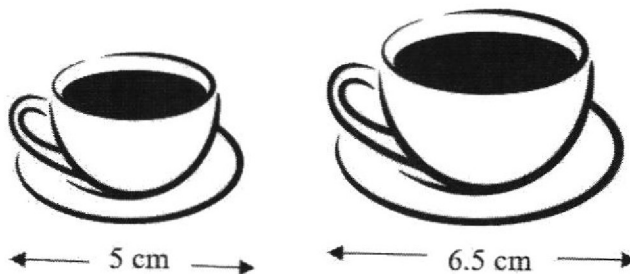
Answer [1]

- 19 The number of blue, white and black masks Julian has is in the ratio 3 : 4 : 5. After exchanging 30 black masks for blue ones, the ratio becomes 9 : 10 : 11.

Find the number of blue masks Julian has now.

Answer masks [4]

20



The diagram shows two geometrically similar cup and saucer sets.
 The diameter of the smaller saucer is 5 cm.
 The diameter of the larger saucer is 6.5 cm.
 A coffee shop sells the smaller cup of coffee at \$1 and the larger cup at \$2.

Calculate which is a better buy.
 Explain your answer.

Answer

[4]

- 21 The matrix below shows the results of three baseball teams in a series of competition.

$$\mathbf{R} = \begin{matrix} & \begin{matrix} \text{Win} & \text{Draw} & \text{Lose} \end{matrix} \\ \begin{pmatrix} 12 & 5 & 3 \\ 3 & 8 & 7 \\ 9 & 4 & 4 \end{pmatrix} & \begin{matrix} \text{Gratitude} \\ \text{Respect} \\ \text{Compassion} \end{matrix} \end{matrix}$$

- (a) A win gains 3 points, a draw 1 point and a loss 0 point.
Represent this information with a 3×1 column matrix \mathbf{P} .

Answer $\mathbf{P} = \dots\dots\dots$ [1]

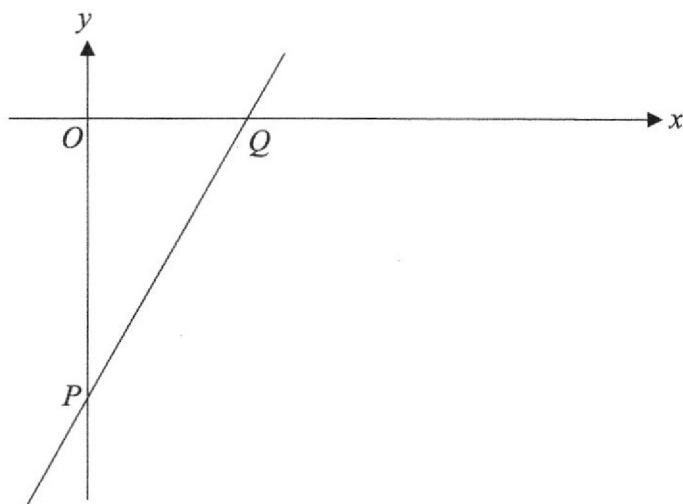
- (b) Evaluate the matrix \mathbf{RP} .

Answer $\mathbf{RP} = \dots\dots\dots$ [2]

- (c) Explain what your answer to (b) represents and state the name of the winning baseball team.

Answer
.....
..... [1]

- 22** The diagram shows a sketch of the graph of $y = -10 + 2x$.
The line crosses the axes at P and Q .



- (a)** Find the coordinates of P and Q .

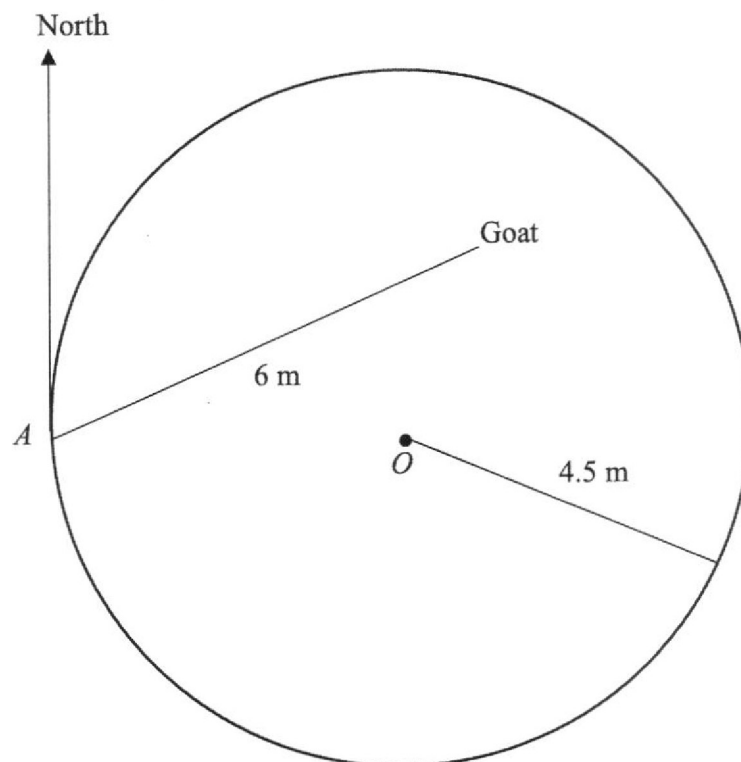
Answer $P(\dots\dots\dots, \dots\dots\dots)$.

$Q(\dots\dots\dots, \dots\dots\dots)$ [2]

- (b)** Calculate the length of the line joining P to Q .

Answer $\dots\dots\dots$ units [2]

23



The diagram shows a goat tied to a pole at A .
 The length of the rope attached to the goat is 6 m.
 A is due west of the centre of the circle, O .

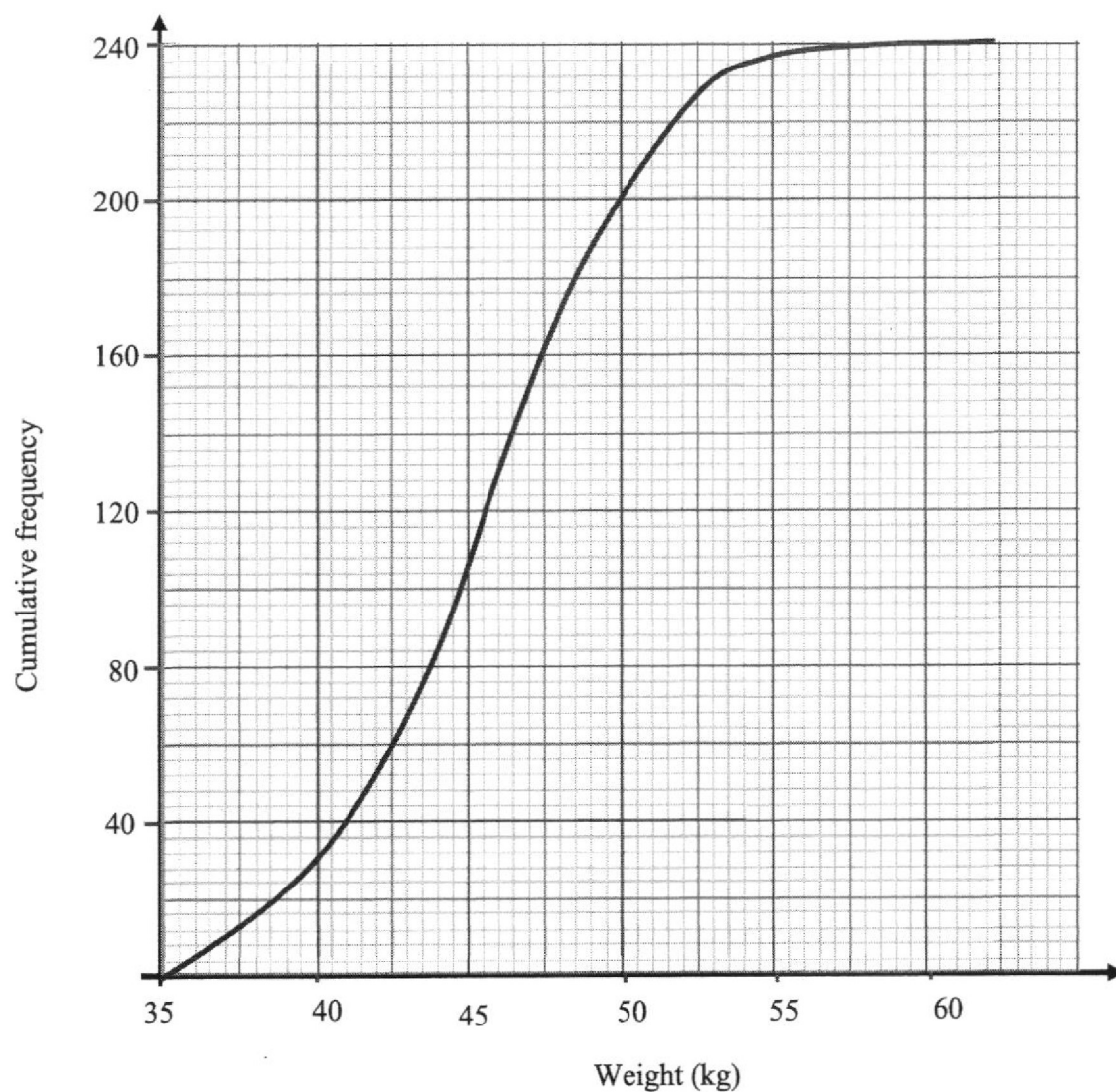
- (a) **Measure** the bearing of the goat from A .

Answer ° [1]

- (b) The circle represents a grass patch of radius 4.5 m.
Find the probability that the goat is in the grass patch.

Answer [3]

- 24 The cumulative frequency graph below shows the weight of 240 students in a school.



Use the graph to find

- (a) the number of students with a weight greater than 55 kg,

Answer [1]

- (b) the interquartile range,

Answer kg [2]

- (c) the median.

Answer kg [1]

It was discovered that the weighing machine used to measure the weight of the students was faulty.

The weight of each of the students was supposed to be 5 kg more than their recorded weights.

- (d) Explain how the cumulative frequency curve of the corrected weights will differ from the given curve.

Answer

[2]

25 The first four terms of a sequence are 5, 9, 13 and 17.

(a) Write down the 8th term of the sequence.

Answer [1]

(b) Find an expression, in terms of n , for the n th term of the sequence.

Answer [2]

(c) One term of the sequence is 205.

Find the value of n for this term.

Answer $n =$ [1]

(d) Explain why 50 is not part of the sequence.

Answer

[2]