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南 华 中 学

NAN HUA HIGH SCHOOL

PRELIMINARY EXAMINATION 2023

Subject : Mathematics
Paper : 4052/01
Level : Secondary Four Express
Date : 17 August 2023
Duration : 2 hours 15 min

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class 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.

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.

		For Examiner's Use
U		
P		
A		

This paper consists of 26 printed pages and 2 blank pages.

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

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

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

Answer **all** questions.

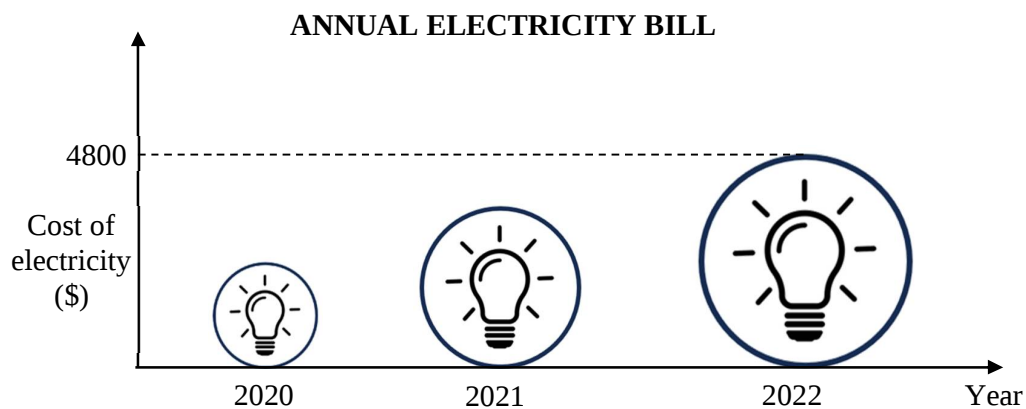
- 1 $3^x = 3^{11} + 3^{11} + 3^{11}$
Find the value of x .

Answer $x = \dots\dots\dots$ [1]

- 2 Charles invested with a bank that pays interest of 3.5% per annum compounded half-yearly.
He received \$3500 as interest at the end of 3 years.
Find the original amount that Charles invested.
Give your answer to the nearest dollar.

Answer \$ [2]

- 3 Ken draws this graph to show his annual electricity cost for his 5-room flat for year 2020, 2021 and 2022.



State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

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..... [2]

- 4 The marked price of a 65-inch Ultra HD 4K TV is \$6000.
Mr Lim buys the TV on hire purchase scheme with down payment of 20% on the marked price.
He then pays monthly instalments over 4 years at a simple interest rate of 1.37% per annum.
Calculate the total amount that Mr Lim pays for the television.

Answer \$ [2]

- 5 The table shows the time, to the nearest hours, taken by 12 students to complete a project.

Time t (hours)	Frequency
$30 \leq t < 35$	1
$35 \leq t < 40$	2
$40 \leq t < 45$	5
$45 \leq t < 50$	4

- (a) Calculate an estimate for the mean time taken.

Answer hours [1]

- (b) Calculate an estimate for the standard deviation of the time taken.

Answer hours [1]

6 The average mass of haemoglobin in a red blood cell is about 31 picograms.

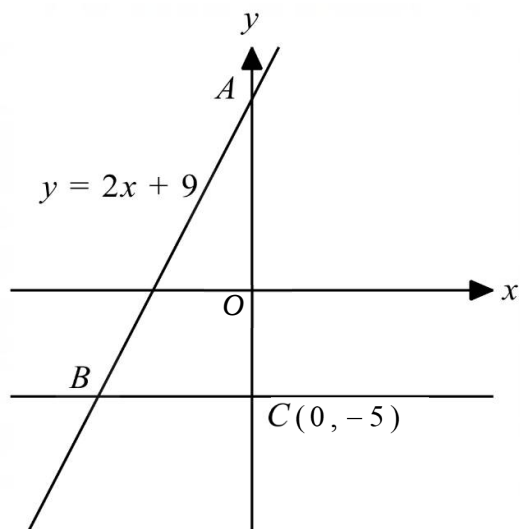
- (a)** Express 31 picograms in grams, giving your answer in standard form.
[1 picogram = 10^{-12} grams]

Answer g [1]

- (b)** There are 5×10^6 red blood cells in 1 cubic millimetre of blood.
Calculate the mass, in grams, of haemoglobin in 1 cubic millimetre of blood.
Give your answer in standard form.

Answer g [1]

- 7 In the diagram, C is the point $(0, -5)$ and A is a point on the y -axis.
The line AB meets the horizontal line through C at point B .
The equation of line AB is $y = 2x + 9$.



- (a) State the equation of the line parallel to line AB , passing through $(0, 7)$.

Answer [1]

- (b) Find the coordinates of point A and point B .

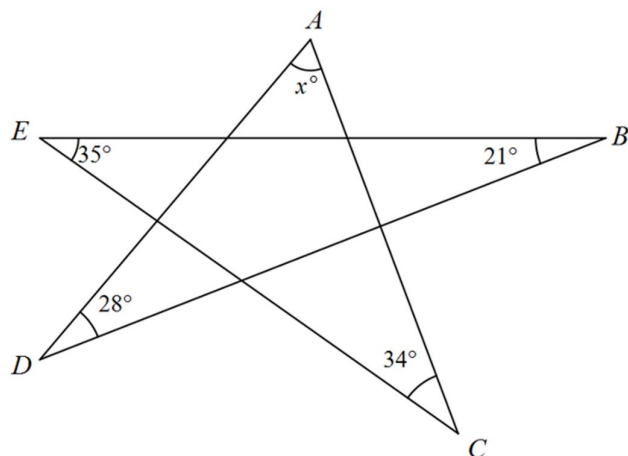
Answer A (.....,)

B (.....,) [2]

- 8 The ratio of the number of employees in company P to that in company Q was 3: 4.
8 employees left company Q to join company P .
The number of employees in company P now is 4 more than company Q .
Find the original number of employees in company P .

Answer [3]

9



Straight lines AC , AD , BE , BD , CE intersect to form the figure in the diagram.
Find the value of x .

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

10 (a) Factorise completely $3fg + 1 - g - 3f$.

Answer [2]

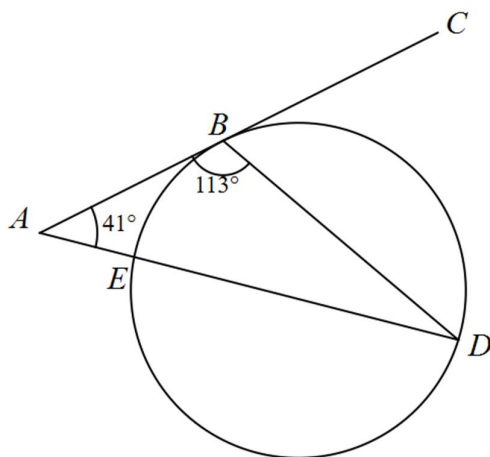
(b) Factorise completely $44 - 11k^2$.

Answer [2]

11 Make x the subject of the formula $w = \frac{2x + y}{3x - y}$.

Answer [3]

12



In the diagram, ABC is a tangent to the circle.
The line AD cuts the circle at E .
Angle $BAD = 41^\circ$ and angle $ABD = 113^\circ$.

Explain why ED is not a diameter of the circle.
Give reasons for each step of your working.

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[3]

13 Written as the product of its prime factors, $8316 = 2^2 \times 3^3 \times 7 \times 11$.

(a) Express 840 as the product of its prime factors.

Answer 840 = [1]

(b) (i) Hence write down the LCM of 8316 and 840, giving your answers as the product of its prime factors.

Answer LCM = [1]

(ii) Hence write down the greatest integer that will divide 8316 and 840 exactly.

Answer [1]

14 $\vec{PQ} = \begin{pmatrix} 6 \\ -8 \end{pmatrix}.$

(a) Find $|\vec{PQ}|.$

Answer $|\vec{PQ}| = \dots\dots\dots$ [1]

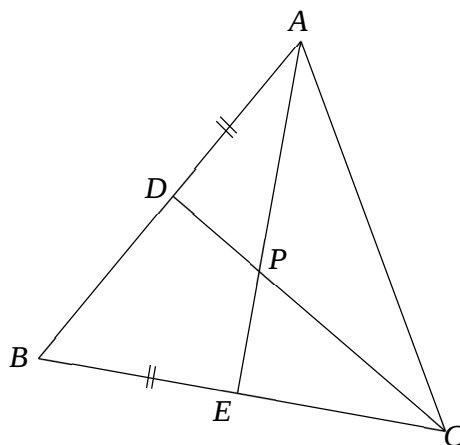
(b) R is the point (2, -9).

$$\vec{SR} = 2\vec{PQ}.$$

Find the coordinates of S.

Answer S (.....,) [2]

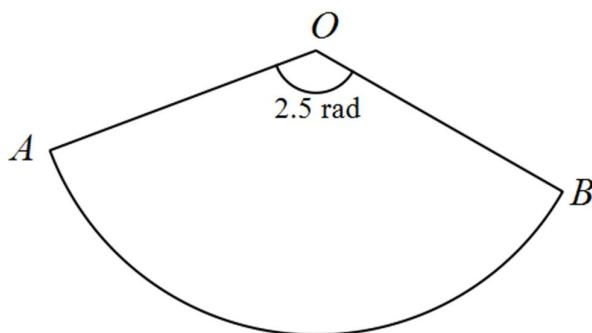
- 15 The diagram shows an equilateral triangle ABC .
 D and E are points on AB and BC respectively such that $AD = BE$.
 AE meets CD at P .



Show that triangle ABE is congruent to triangle CAD .
Give a reason for each statement you make.

Answer

16



The diagram shows the sector of a circle, AOB .

The perimeter of sector is 81 cm and angle AOB is 2.5 radian.

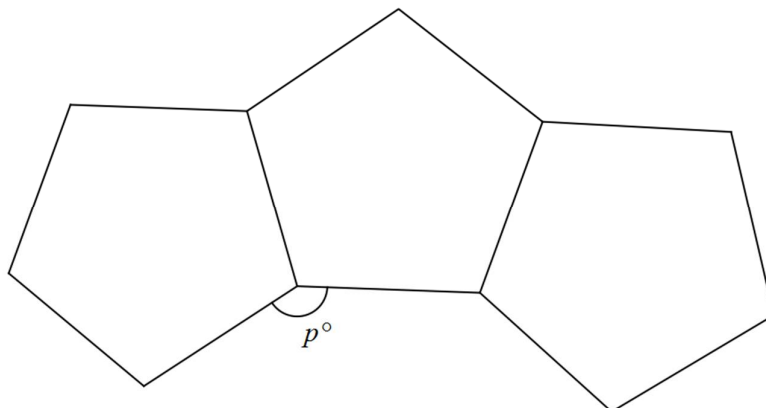
- (a) Find the radius of the sector.

Answer cm [2]

- (b) The sides, OA and OB , are joined to form a cone.
Find the radius of the cone.

Answer cm [2]

17



The diagram shows three regular pentagons joined together on its edges.

- (a) Find the value of p .

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

- (b) Additional regular pentagons are added to these 3 pentagons to form a closed ring.
Find the total number of pentagons that are used to form this ring.

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

- 18** In a sequence, the same number is subtracted each time to obtain the next term.
The first five terms of the sequence are

68 a b c 24.

- (a)** Find the values of a , b and c .

Answer $a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$ [2]

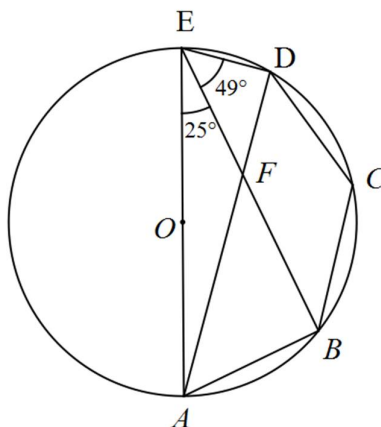
- (b)** Write down an expression for the n th term of this sequence.

Answer $\dots\dots\dots$ [1]

- (c)** Explain why -524 is not a term of this sequence.

$\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$ [1]

19



O is the centre of the circle passing through A , B , C , D and E .
Chords BE and AD cuts at F .
Angle $AEB = 25^\circ$ and angle $BED = 49^\circ$.

- (a) Show that triangle ABF is similar to triangle EDF .
Give a reason for each statement you make.

[2]

- (b) Find angle BCD .
Give a reason for each step of your answer.

Answer angle $BCD = \dots\dots\dots$ [2]

- 20 $\mathcal{C} = \{x \text{ is an integer: } 1 \leq x \leq 15\}$
 $F = \{\text{prime numbers}\}$
 $G = \{x : 5 < x \leq 12\}$

(a) List the elements in F .

Answer [1]

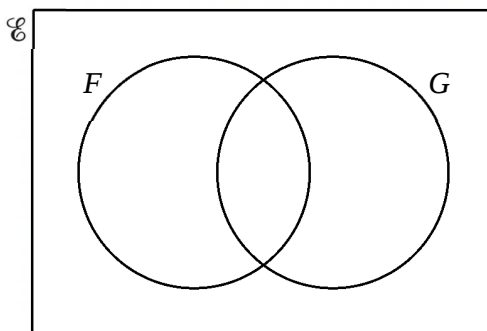
(b) State the value of $n(G)$.

Answer [1]

(c) List all the elements in $(F \cup G)'$.

Answer [1]

(d) On the Venn diagram, shade the region which represents $F \cap G'$.



[1]

- 21 The ratio of surface area of 2 similar solid spheres is 4: 9.
The radius of the smaller sphere is 6 cm.

(a) Find the radius of the larger sphere.

Answercm [1]

(b) Express the total the volume of the 2 solid spheres in terms of π .

Answercm³ [2]

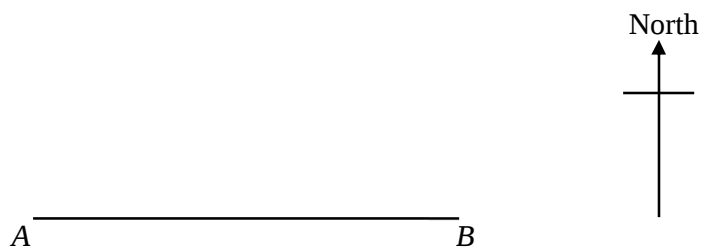
- (c) The spheres are melted and recast into 2 solid cones, A and B .
The radius and height of cone A is 6 cm and 10 cm respectively.
The radius of cone B is 12 cm.
Showing your working clearly, explain if the 2 cones are similar.

Answer

[2]

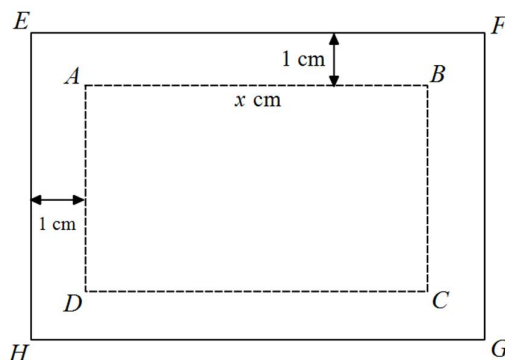
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- 22 The diagram shows the location of 2 towns, A and B .



- (a) Construct the perpendicular bisector of AB . [1]
- (b) Another new town, C , is to be built on a bearing of 210° from town B .
It is equidistant from town A and town B .
Mark the position of town C . [2]
- (c) Construct the angle bisector of angle BAC . [1]
- (d) A telecommunication tower, T , serving the 3 towns is to be built so that it is
equidistant from AB and AC , and equidistant from town A and B .
Mark the position of T . [1]

23



The diagram shows a photograph, $ABCD$, length x cm and perimeter 40 cm.
It is mounted on a piece of rectangular cardboard, $EFGH$.
There is a uniform border of 1 cm width around the photograph.

- (a) The area of the rectangular cardboard, $EFGH$, is $S \text{ cm}^2$.
Show that it can be expressed as $S = -x^2 + 20x + 44$.

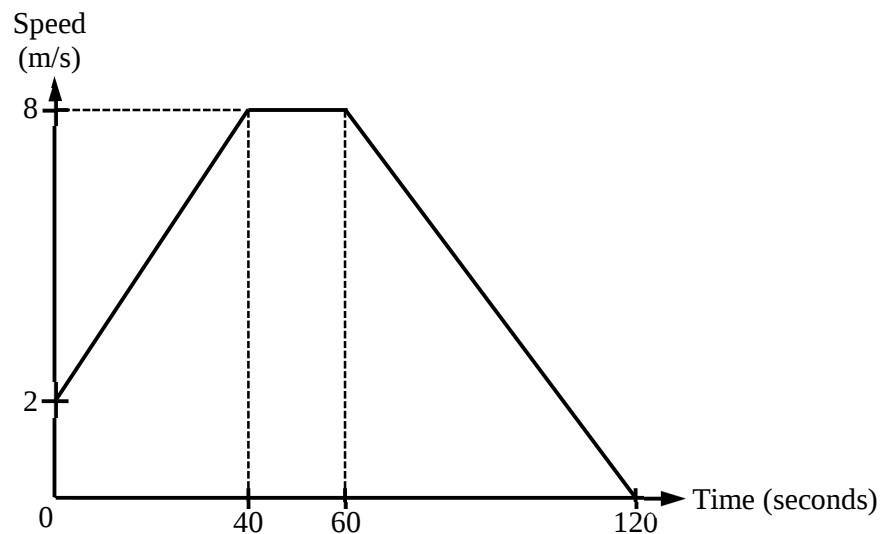
Answer

[3]

- (b) Jane claims that the area of the rectangular cardboard, S , can be greater than 150 cm^2 .
Explain if the claim is correct.

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..... [2]

- 24 The diagram shows the speed-time graph of a cyclist after passing a fixed point, A.



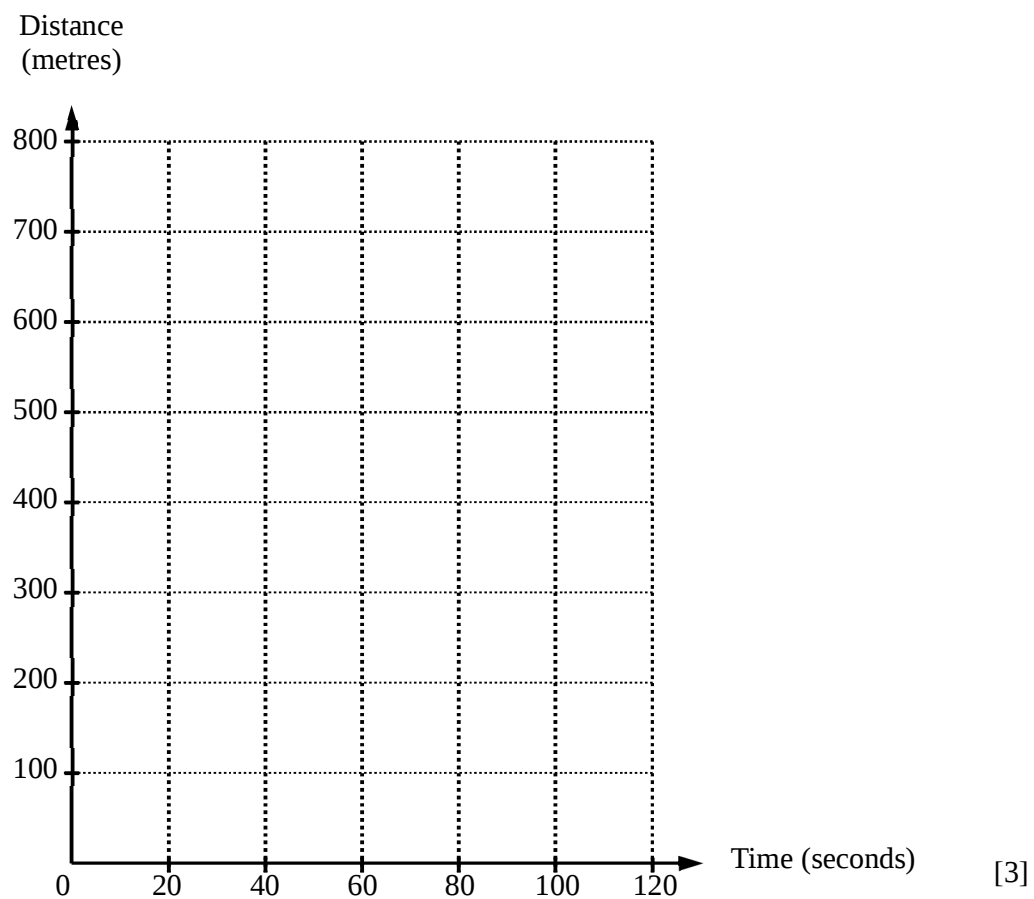
- (a) Calculate the acceleration of the cyclist during the first 10 seconds after passing point A.

Answer m/s^2 [1]

- (b) Calculate the average speed, in m/s, of the cyclist in the last 80 seconds.

Answer m/s [2]

- (c) On the grid below, sketch the distance-time graph for the journey.



- 25 (a) The table shows the choice of CCA for Secondary One students in a school.

	Sports	Clubs and Society	Performing Arts	Total
Males	70	26	72	168
Females	38	a	c	d
Total	108	b	141	316

- (a) Find the values of a , b , c and d in the table.

Answer $a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$

$d = \dots\dots\dots$ [2]

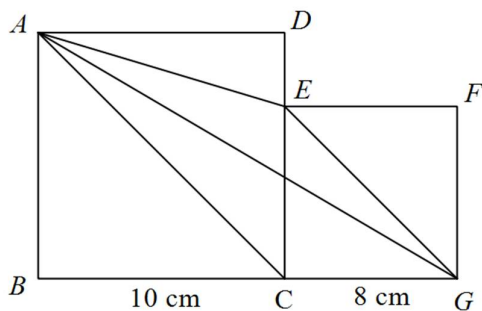
- (b) A pie chart is to be drawn showing the data for **males**.
Calculate the angle representing the males who choose Sports.

Answer $\dots\dots\dots$ [1]

- (c) Determine in which group, males or females, did a greater percentage choose Performing Art.
Explain your answer.

.....
.....
.....
.....
..... [2]

26



The diagram shows two squares, $ABCD$ and $CGFE$, of lengths 10 cm and 8 cm respectively.

(a) Find the length of AG .

Answer cm [1]

(b) Show that AC is parallel to EG .
Give a reason for each statement you make.

Answer

[2]

(c) Find the area of triangle AGE .

Answercm² [3]

----- End of Paper -----

Answer Key

1 $x = 12$

2 31905

3 It is not clear as to whether the height of the lightbulb or the area of the circle should be used to determine the annual electricity bill. Or
The size of the picture not only increases with height, but also in the width.

When using area, the cost looks 4 times more in 2022 as compared to 2020. If using the height of the lightbulbs, the cost in 2022 looks twice as much in 2020.

4 \$6263.04

5a 42.5 hours

5b 4.56 hours (3 s.f.)

6a 3.1×10^{-11} grams

6b 1.55×10^{-4} g

7a $y = 2x + 7$

7b $A = (0, 9)$
 $B = (-7, -5)$

8 36

9 62

10a $(g - 1)(3f - 1)$

10b $11(2 - k)(2 + k)$

11 $x = \frac{y(1+w)}{3w-2}$ or $\frac{y+wy}{3w-2}$

13a $2^3 \times 3 \times 5 \times 7$

13bi $2^3 \times 3^3 \times 5 \times 7 \times 11$

13bii 84

14a 10 units

14b $(-10, 7)$

16a 18 cm

16b 7.16 cm (3 s.f.)

17a 144

17b 10

18a $a = 57, b = 46, c = 35$

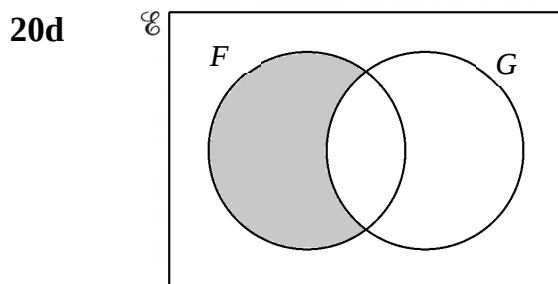
18b $79 - 11n$ or $68 - 11(n - 1)$

19b 131°

20a $F = \{2, 3, 5, 7, 11, 13\}$

20b 7

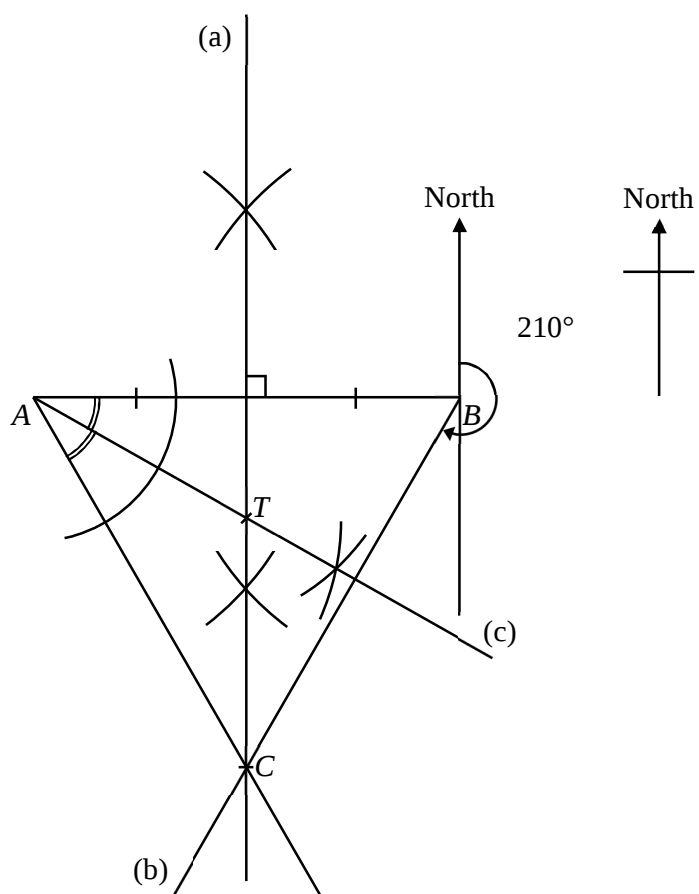
20c $\{1, 4, 14, 15\}$



21a 9

21b $1260\pi \text{ cm}^2$

22

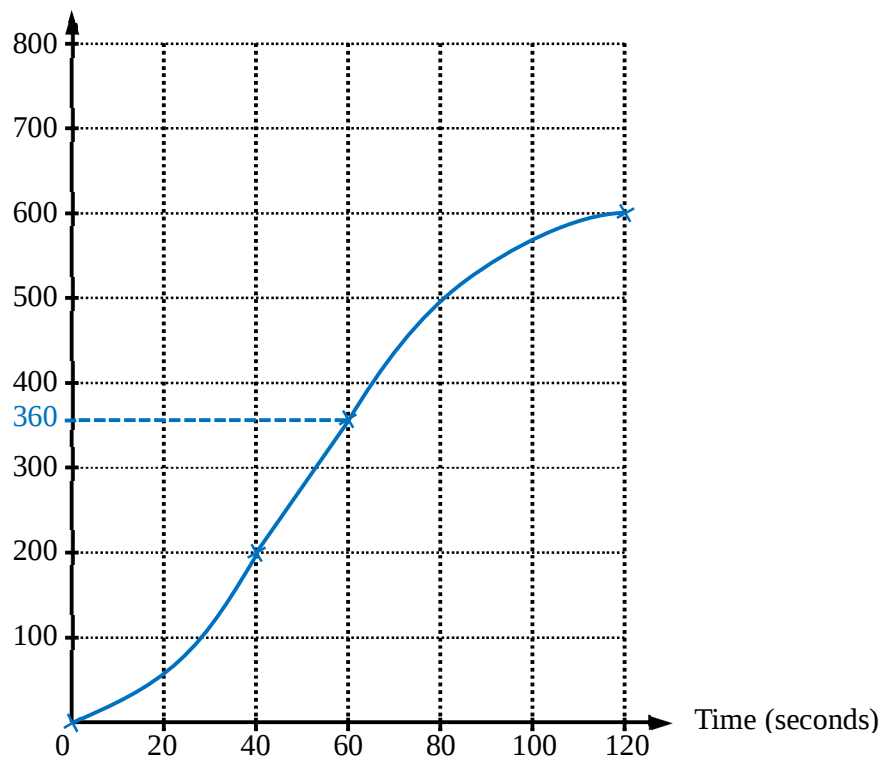


24a 0.15 m/s^2

24b 5 m/s

24c

Distance
(metres)



25a $a = 41, b = 67, c = 69$
 $d = 148$

25b 150°

26a 20.6 cm

26c 32 cm^2