Answer **all** the questions.

1 Solve $\frac{3}{x} + 12 = 5$.

Answer……..[1]

---

2 Factorise completely $3ax^2 - 2bx^2 - 3a + 2b$.

Answer …….[3]

---

3 Solve the inequalities $-7 \leq 9 - 2x < 3$.

Answer ..... [2]

---

4 A farmer has 1500 tomato plants. He wants to apply 220 ml of liquid fertilizer to each plant. The fertilizer is sold in containers each holding 50 litres and costing $ 235. Calculate how much the farmer has to pay for the fertiliser.
[1 litre = 1000 ml]

Answer $.....[2]

---

5 **(a)** Given that $8 \times 16^{-a} = 1$, find a.

Answer **(a)** a =……..[2]

(b) Mercury is the fastest planet with an orbital speed of 1.72×10^5 km/h.
Neptune is the slowest planet with an orbital speed of 1.95×10^4 km/h.
Given that the orbital speed of Mercury is ***k*** times of the orbital speed of Neptune, find the value of ***k***. Give your answer to a sensible degree of accuracy.

Answer **(b)** ***k*** =…….[1]

---

6 Express as a single fraction in its simplest form $\dfrac{2}{(t-2)^2} - \dfrac{3}{(4-2t)}$.

.

Answer …….[3]

---

7 The mean weight of five rocks on Earth was 3.462 N. The standard deviation of the weights of the five rocks was 0.0683 N.
The five rocks were then weighed on the Moon. The weights of the five rocks on the moon were 16.5% of their weights on Earth.
For the weights of the five rocks on the Moon, find
(a) the mean,
(b) the standard deviation of the weights.

Answer **(a)** ……..N[1]

(b) …..……N[1]

---

8 The initial population of some biological organisms is 600.
The population, P organisms, after t days is given by the formula

$$P = 600 \times 3.21^{t}.$$

(i) Calculate P when $t = 3$.
Give your answer correct to the nearest whole number.

Answer **(i)** P = ……[1]

(ii) Find the percentage increase in the population over the first 3 days.

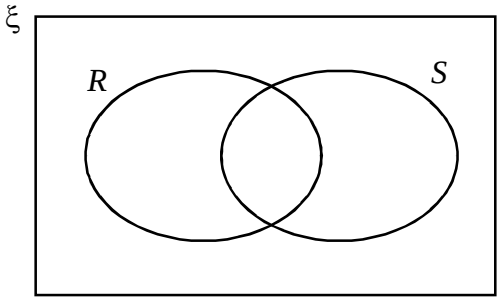
Answer **(ii)** ……% [2]

---

9 ξ = {all triangles}
R = {right-angled triangles}
S = {isosceles triangles}

A is a triangle with angles $45°$, $45°$ and $90°$.
B is a triangle with sides 6 cm, 6 cm and 3 cm.
C is a triangle with sides 3 cm, 4 cm and 5 cm.

On the Venn Diagram below, write A, B and C in the appropriate subsets.



[3]

---

10 Ahmed , Baz and Colin share a bag of Jelly sweets.

Ahmed takes $\frac{3}{8}$ of the Jelly sweets.

Baz takes 70% of the remaining Jelly sweets and Colin takes the other 12 Jelly sweets. How many Jelly sweets are in the bag altogether?

Answer ….....[3]

---

11 Roger can assemble 7 toy cars in 5 hours.
Paul can assemble 8 toy cars in 6 hours.
Roger and Paul work together to assemble a total of 20 toy cars.
If they continue to assemble at the same rate, how long will it take them to assemble the 20 toy cars? Give your answer in hours and minutes, to the nearest minute.

Answer ….....[3]

---

12 Sally is drawing a quadrilateral *ABCD* such that *AB* is parallel to *DC*. The angles, in degrees, of the quadrilateral are angle $DAB = 10x + 70$, angle $ABC = 61 - 3x$, angle $BCD = 56 + 12x$ and angle $ADC = 6x - 2$.

.

(a) Calculate the value of x.

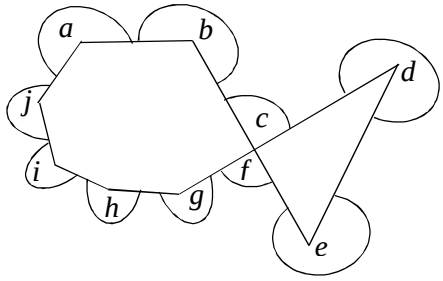
Answer x = ….....[1]

(b) What is the special name of the quadrilateral? Justify your answer.

Answer ..... [2]

---

13 The diagram shows a heptagon and a triangle.



(a) Find the sum of the interior angles of the heptagon.

Answer **(a)** ..... [1]

(b) Calculate the sum of the angles *a, b, c, d, e, f, g, h, i* and *j* in this diagram.

Answer **(b)** ..... [2]

14 **(a)** Express 4536 as the product of its prime factors.

Answer **(a)** ..... [1]

(b) Given that $\frac{4536}{k} = p^3$, where k and p are integers and p is as large as possible. Find the value of k .

Answer **(b)** ..... [1]

(c) The lowest common multiple of two numbers is 4536. The highest common factor of these two numbers is 189. Given that both numbers are between 189 and 4536, find the two numbers.

Answer **(c)** ……..... , ... [2]

15 A group of solid cones have equal heights.
The mass, M grams, of each cone is directly proportional to the square of its radius, r centimetres.

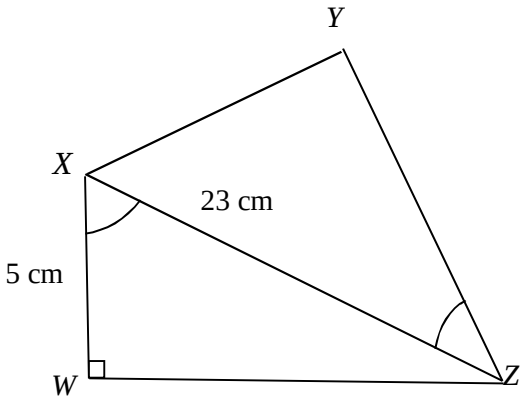
(a) When the radius of the cone is R cm, the mass of the cone is 384 grams.
Find the mass when the radius is $\frac{1}{4}R$ cm.

Answer **(a)** .....grams [2]

(b) One of the cones, A, has a radius 25% more than cone B.
Write down the ratio of the mass of cone A to the mass of cone B.

Answer **(b)** ..... : ..... [2]

16 In triangles *WXZ* and *XYZ*, angle *XWZ* = 90°, angle *WXZ* = angle *XZY*.
WX = 5 cm and *XZ* = 23 cm.



(a) Calculate angle *WXZ*.

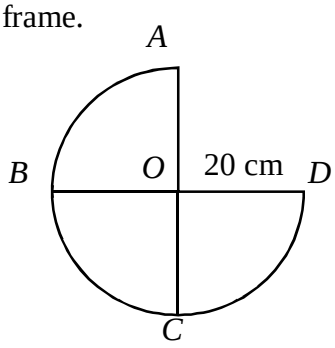
Answer **(a)** .....[2]

(b) Find the shortest distance from *X* to *ZY* produced.

Answer **(b)** ..... cm [2]

17 The diagram shows a two dimensional frame. It consists of three quarters of a circle of radius 20 cm and centre *O*. *OA, OB, OC, OD* and the arc *ABCD* are made of wire.

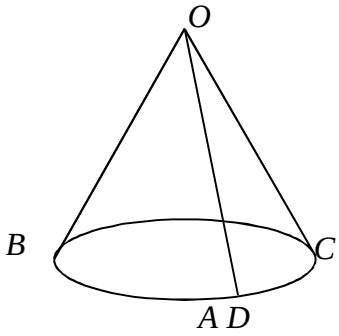
(a) Calculate the total length of the wire used for the frame.



Answer **(a)** .....cm [2]

The frame is now bent into a cone by folding the arc *ABCD* into a circle and joining the radii *OA* and *OD*. The cone is used as a framework for a lampshade.

(b) Calculate the area of fabric needed to cover the curved surface of the lampshade.



Answer **(b)** .....cm^2 [2]

18 The table shows the discounts given to members of a dance studio. The membership fee is \$30.

Class	Members' discount
Chacha	20%
Samba	15%
Tango	10%

Kelly is interested to sign up for the Samba class which costs \$350.

(a) Calculate how much she saves if she becomes a member and then signs up for the Samba class.

Answer **(a)** \$ ..... [2]

After she has joined as a member and signed up for the Samba class, she was offered a further 12% discount on the members' prices for the Chacha and Tango classes.

(b) Write down a formula for P, the total amount, in dollars, that she needs for her Chacha and Tango classes. Use U and V to represent the original price, in \$, for the Chacha and Tango classes respectively.

Answer **(b)** P = ... [2]

19 P is the point (0, 3), Q is the point (5, 7) and R is the point (a, 2).

(a) The product (gradient of PQ) $\times$ (gradient of QR) $= -1$.
Use this information to show that $a = 9$.

Answer **(a)**

[2]

(b) The line PQ is perpendicular to the line QR.

(i) Use vectors to find the coordinates of the point S such that $PQRS$ is a rectangle.

Answer **(b)(i)** (....., ...) [2]

(ii) Calculate the area of rectangle $PQRS$.

Answer **(b)(ii)** .....units^2 [2]

20 In cinema *E*, the costs of a movie ticket for an adult, a senior citizen and a child are \$12, \$8 and \$6 respectively.
In cinema *F*, the costs of a movie ticket for an adult, a senior citizen and a child are \$2 less, \$1 more and \$1 more respectively.

This information can be represented by the matrix $\mathbf{Q} = \begin{matrix} \\ A \\ S \\ C \end{matrix} \begin{matrix} E & F \\ \end{matrix} \begin{pmatrix} 12 & -2 \\ 8 & 1 \\ 6 & 1 \end{pmatrix}$.

(a) Betty and Wendy want to buy tickets for their families.
Betty needs to buy tickets for 3 adults, 2 senior citizens and 4 children.
Wendy needs to buy for 4 adults, 1 senior citizens and 5 children.
Represent their purchases in a 2×3 matrix **P**.

Answer **(a)** $\mathbf{P} = \begin{pmatrix} & & \\ & & \end{pmatrix}$ [1]

(b) Evaluate the matrix $\mathbf{R} = \mathbf{PQ}$.

Answer **(b)** $\mathbf{R} = \begin{pmatrix} & \\ & \\ & \end{pmatrix}$ [2]

(c) How much money would Wendy save by buying from cinema *F* ?

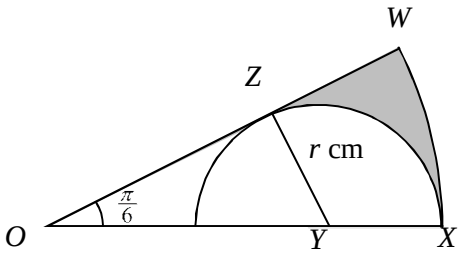
Answer **(c)** \$ ..... [1]

(d) Betty buys the movie tickets from cinema *E*.
She uses a credit card to make the purchase which gives her a discount of 10%.
Find the total amount she pays for her family.

Answer **(d)** \$ ..... [2]

21 In the figure, *OWX* is a sector of a circle with centre *O* and angle *WOX* = $\frac{\pi}{6}$ radians.

A semicircle with radius *r* cm and centre *Y* is drawn as shown.
OW touches the semicircle at *Z*.



Find, in terms of *r*,

(i) (a) the length of *OY*,

Answer **(i)(a)** ..... cm [2]

(b) the area of triangle *OZY*.

Answer **(i)(b)** ….....cm^2 [2]

(ii) If $r = 5$, calculate the area of the shaded region.

Answer **(ii)** …..... cm^2 [3]

22 **(a)** A box contains three red balls, two green balls and one yellow ball.
Two balls are taken at random with replacement.
Giving your answer as a fraction in its simplest form,
find the probability that Claire picks

(i) two balls of the same colour,

(ii) at least one green ball.

Answer **(a)(i)** .....[2]

(ii) .....[2]

(b) A bag contains one Mint sweet, two Toffees and one Chocolate sweet.
A second bag contains two Mint sweets and two Toffees.
Claire picks one sweet from each bag.

(i) Complete the table to show all the possible outcomes.

		Sweet from second bag			
		M	M	T	T
Sweet from first bag	M	MM			
	T	TM			
	T				
	C				

Answer [1]

(ii) Giving your answer as a fraction in its simplest form, find the probability that Claire picks

(a) two Toffees,

(b) at most one Mint.

Answer **(b)(ii)(a)** .....[1]

(ii)(b) .....[1]

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