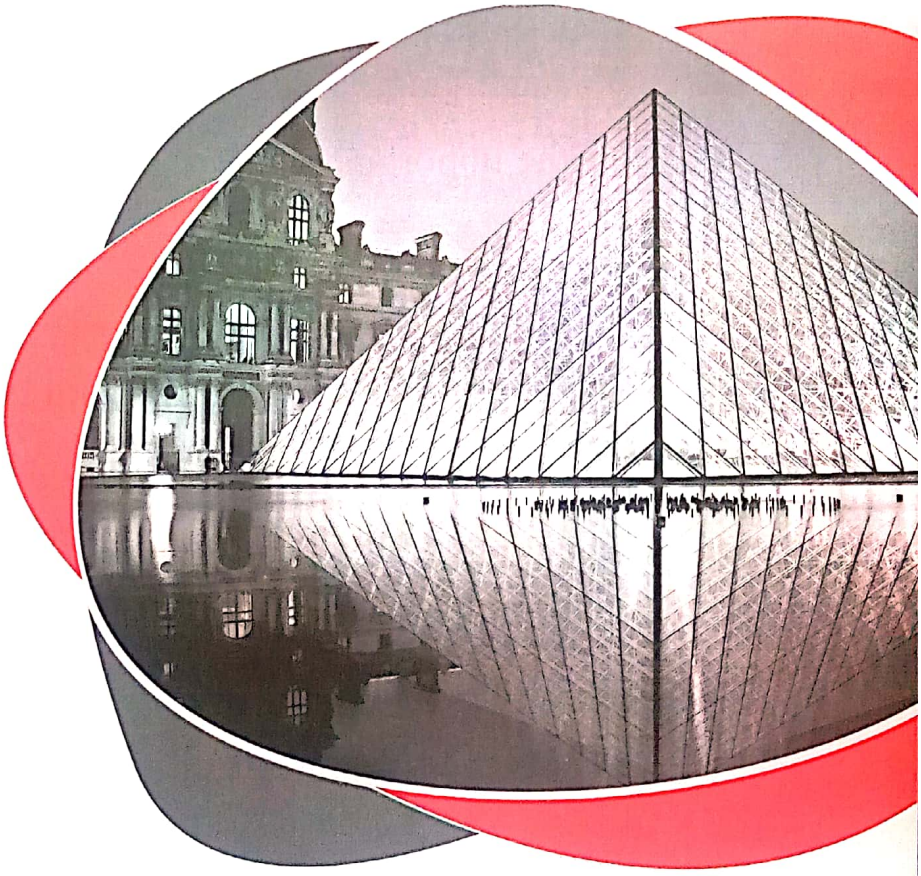
SCIENTIFIC SECTION

Mathematics

Applications

By a group of supervisors



FIRST TERM 2 SEC.

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EL-MOASSER
Examinations

Total mark

Quiz 1 on lesson 1 – unit 1

10

Answer the following questions :

First question *4 marks* 1 mark for each item

Choose the correct answer from those given :

(1) $\overrightarrow{F_1} = 2\hat{i} + 3\hat{j}$, $\overrightarrow{F_2} = \hat{i} + \hat{j}$ where F_1 , F_2 are measured in newton then the magnitude of their resultant ..... newton.

(a) $\sqrt{2}$ (b) $\sqrt{5}$ (c) $\sqrt{13}$ (d) 5

(2) Two forces are equal act at a point and the measure of the angle between them is $\frac{\pi}{3}$ and their resultant is 3 newton , then the magnitude of each is ..... newton.

(a) $\frac{3}{2}$ (b) $\sqrt{3}$ (c) 3 (d) $3\sqrt{3}$

(3) The resultant of two forces acting at a point is maximum when the included angle between them is equal to .....

(a) zero (b) 60° (c) 120° (d) 180°

(4) The magnitude of the resultant of two forces 3 , 5 newton and the measure of their included angle is 60° equals ..... newton.

(a) 2 (b) 6 (c) 7 (d) 8

Second question *3 marks*

The magnitude of two forces are F , 4 newton acting at a point , and the measure of the angle between them is 120° , the magnitude of their resultant equals $4\sqrt{3}$ newton , find the magnitude of $\overrightarrow{F}$ and the angle measure between their resultant and the force $\overrightarrow{F}$

Third question *3 marks*

The magnitude of two forces are 4 , F newton acting at a point , and the measure of the angle between them is 120° , their resultant is perpendicular on the first force. Find the value of F

Quiz 2 till lesson 2 – unit 1

Total mark 10

Answer the following questions :

First question *4 marks* 1 mark for each item

Choose the correct answer from those given :

(1) Two forces of magnitude 3 F and 2 F intersecting at a point and their resultant is 5 F , then the measure of the angle between them is .....

(a) zero° (b) 60° (c) 20° (d) 180°

(2) As resolving the force $\vec{R}$ into two forces $\vec{F_1}$ and $\vec{F_2}$ making with $\vec{R}$ two angles of measure θ_1 and θ_2 on both sides of $\vec{R}$ respectively , then the magnitude of $\vec{F_1}$ = ...

(a) $\frac{R \sin \theta_1}{\sin (\theta_1 + \theta_2)}$ (b) $\frac{R \sin \theta_2}{\sin (\theta_1 - \theta_2)}$ (c) $\frac{R \sin \theta_2}{\sin (\theta_1 + \theta_2)}$ (d) $\frac{R \sin (\theta_1 + \theta_2)}{\sin \theta_2}$

(3) Two forces of equal magnitudes , inclosing between them an angle of measure 90° If the magnitude of their resultant is 8 N , then the value of each force measured in newton is .....

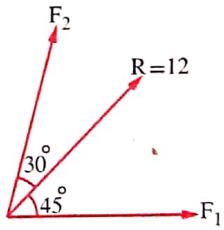
(a) $2\sqrt{2}$ (b) 4 (c) $4\sqrt{2}$ (d) 8

(4) **In the given figure :**

F_1 = ...

(a) 12 cos 75° (b) 12 cos 45°

(c) 6 sec 45° (d) 6 csc 75°



Second question *3 marks*

Two forces of magnitudes 4 , F newton act at a point and the measure of their included angle is 135° Given that their resultant makes angle 45° with the force F , find F and the magnitude of their resultant.

Third question *3 marks*

Resolve a force 100 newton in two directions the first inclines by 60° to the force and the other by 30° in the other side of the given force.

Quiz 3 till lesson 3 – unit 1

Total mark 10

Answer the following questions :

First question *4 marks* 1 mark for each item

Choose the correct answer from those given :

(1) A body of weight (W) is placed on an inclined plane makes angle of measure θ to the horizontal then the component of its weight in direction of line of greatest slope equals .....

(a) W cos θ (b) W sin θ (c) W tan θ (d) W

(2) Two perpendicular forces of magnitude 12 newton , 5 newton act at a point , then the magnitude of their resultant = ... newton.

(a) 17 (b) 7 (c) 13 (d) 14

(3) Given : $\overrightarrow{F_1} = 3\,\hat{i} - 2\,\hat{j}$, $\overrightarrow{F_2} = a\,\hat{i} - \hat{j}$, $\overrightarrow{F_3} = 4\,\hat{i} - b\,\hat{j}$ and their resultant $\overrightarrow{R} = 6\,\hat{i} - 4\,\hat{j}$, then a + b = ...

(a) 2 (b) – 2 (c) zero (d) – 1

(4) Given : $\overrightarrow{F_1} = 5\,\hat{i}$, $\overrightarrow{F_2} = 7\,\hat{i} - 5\,\hat{j}$, $\overrightarrow{R}$ is their resultant then $\| \overrightarrow{R} \|$ = ...

(a) $\sqrt{5} + \sqrt{74}$ (b) 49 (c) 13 (d) $\sqrt{12} - \sqrt{5}$

Second question *3 marks*

Three coplanar forces of magnitudes 85 , 75 , $50\sqrt{2}$ kg.wt. act at a point , the first acts towards East , the second towards 30° West of the North and the third towards West South. Find the magnitude of their resultant.

Third question *3 marks*

Two forces act at a point , the maximum value of their resultant is 32 kg.wt. and the minimum value of their resultant is 12 kg.wt. Find the magnitude of each force , then find the magnitude of their resultant when the angle between the two forces = 60°

Quiz 4 till lesson 4 – unit 1

10

Answer the following questions :

First question *4 marks* 1 mark for each item

Choose the correct answer from those given :

(1) Three equal forces in magnitudes act at a point and the forces are in equilibrium , then the measure of the angle between any two forces = ...

(a) 60° (b) 90° (c) 120° (d) 150°

(2) The maximum and minimum value respectively of the resultant of the two forces of magnitudes 8 , 13 newton are ..... newton.

(a) 13 , 8 (b) 13 , 5 (c) 21 , 8 (d) 21 , 5

(3) Two forces act at a point of magnitudes 5 , 3 newton and the measure of the angle between them is 60° then the magnitude of their resultant (R) equals ..... newton.

(a) 2 (b) 7 (c) 8 (d) 5

(4) Two forces of equal magnitudes , the magnitude of their resultant is 3 newton and the measure of the angle between them is $\frac{\pi}{3}$, then the magnitude of each ..... newton.

(a) $\sqrt{3}$ (b) 3 (c) $\frac{3}{2}$ (d) $3\sqrt{3}$

Second question *3 marks*

A body of weight 300 gm.wt. is placed on a smooth plane inclined to the horizontal with an angle whose tangent equals $\frac{1}{\sqrt{3}}$ The body is prevented from sliding by a force makes with the line of the greatest slope an angle of measure 30° upwards.

Find the magnitude of the force and the reaction of the plane.

Third question *3 marks*

If : $\overrightarrow{F_1} = 5\vec{i} + 3\vec{j}$, $\overrightarrow{F_2} = a\vec{i} + 6\vec{j}$, $\overrightarrow{F_3} = -14\vec{i} + b\vec{j}$ are three coplanar forces meeting at a point and their resultant is $\overrightarrow{R} = \left(10\sqrt{2} , \frac{3\pi}{4}\right)$, then find the values of a and b

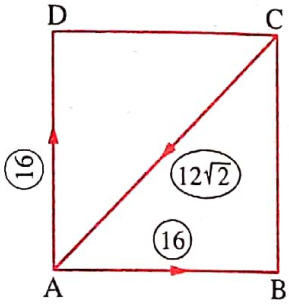
Answer the following questions :

First question *2 marks*

The magnitudes of two forces F , $\sqrt{2}$ F newton act at a point and their resultant is perpendicular to the first force. Find the angle between the two forces and prove that the magnitude of their resultant equals F

Second question *2 marks*

The opposite figure represents the forces 16 , 16 , $12\sqrt{2}$ newton which act in the square ABCD in the directions $\overrightarrow{AB}$, $\overrightarrow{AD}$, $\overrightarrow{CA}$ respectively. Find the magnitude and direction of their resultant.



Third question *4 marks*

A smooth sphere of radius length 30 cm. and of weight 10 gm.wt. rests on a vertical smooth wall. It is suspended by a string of length 30 cm. , one of its ends is attached to a point on the surface of the sphere and the other end is fixed at a point on the wall above the tangency point of the sphere and the wall.

Find the magnitudes of the tension in the string and the reaction of the wall

Fourth question *2 marks*

Three coplanar forces of magnitudes 5 , 10 , $4\sqrt{7}$ newton act at a point , the measure of the angle between the first two forces equals 60° , find the greatest and the smallest magnitude of their resultant.

Quiz 1 on lesson 1 – unit 2 — 10

Answer the following questions :

First question *5 marks* **1 mark for each item**

Choose the correct answer from those given :

(1) All the following cases determine a plane except .....

(a) a straight line and a point not on it. (b) two different parallel straight lines.

(c) two intersecting straight lines. (d) two skew straight lines.

(2) The number of planes which passes through 3 non-collinear points equals .....

(a) 1 (b) 3 (c) 6 (d) infinite numbers.

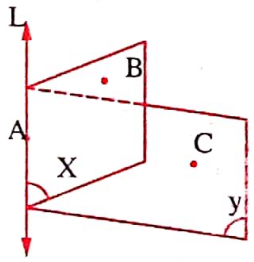
(3) The skew lines .....

(a) never intersect. (b) are not perpendicular.

(c) are not parallel. (d) are neither parallel nor intersecting.

(4) **In the opposite figure :**

The plane X ∩ the plane Y ∩ the plane ABC = ...



(a) {A} (b) the straight line L

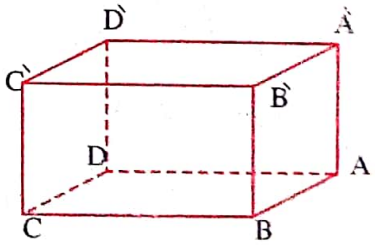
(c) $\overleftrightarrow{AC}$ (d) $\overleftrightarrow{AB}$

(5) If $\overleftrightarrow{AB}$ // plane X , then $\overleftrightarrow{AB} \cap X$ = ...

(a) $\overline{AB}$ (b) $\overrightarrow{AB}$ (c) $\overleftrightarrow{AB}$ (d) ∅

Second question *5 marks* **1 mark for each item**

By using the opposite figure state :



(1) Two parallel planes.

(2) Two intersecting planes.

(3) Two skew straight lines.

(4) A straight line and a plane which are parallel.

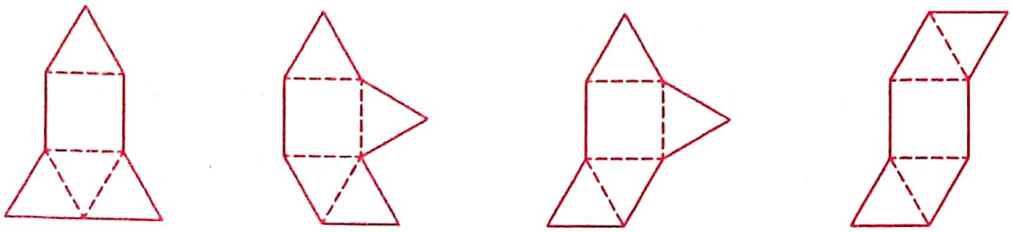
(5) The intersection line of the plane ABB`A` with the plane ACD

Answer the following questions :

First question *4 marks* **1 mark for each item**

Choose the correct answer from those given :

(1) Which of the following nets does not make a regular quadrilateral pyramid when it folded ?



(a) (b) (c) (d)

(2) The volume of a regular quadrilateral pyramid 12 cm^3 and its height 4 cm. then the length of its base side = ... cm.

(a) 1 (b) 2 (c) 3 (d) 4

(3) A regular quadrilateral pyramid , the length of its base side is 10 cm. , and its lateral height is 13 cm. , then its volume in cm^3 = ...

(a) $\frac{1}{2} \times (10)^2 \times 13$ (b) $\frac{1}{3} \times (10)^2 \times 12$

(c) $\frac{1}{2} \times (12)^2 \times 13$ (d) $\frac{1}{3} \times (13)^2 \times 10$

(4) If the sum of edge lengths of a triangular regular faces pyramid equals 18 cm. , then its total area = ... cm^2

(a) $\frac{27\sqrt{2}}{4}$ (b) $\frac{27\sqrt{3}}{4}$ (c) $\frac{27\sqrt{3}}{2}$ (d) $9\sqrt{3}$

Second question *3 marks* **$1\frac{1}{2}$ marks for each item**

The side length of the base of regular quadrilateral pyramid is 20 cm. and its height is $10\sqrt{3}$ cm.

Find : (1) The lateral area. (2) The volume of the pyramid.

Third question *3 marks*

A regular hexagonal pyramid , the side length of its base = 12 cm. and its slant height = $10\sqrt{3}$ cm. Find its total area.

Answer the following questions :

First question *4 marks* 1 mark for each item

Choose the correct answer from those given :

(1) The lateral area of a right cone whose base radius length is 6 cm. and its height = 8 cm. is ..... cm^2.

(a) 60π (b) 28π (c) 10π (d) 48π

(2) A regular quadrilateral pyramid of base side length 10 cm. and its lateral height 13 cm. , its lateral area = ...

(a) 260 cm^2. (b) 360 cm^2. (c) 130 cm^2. (d) 520 cm^2.

(3) The number of planes passes through 3 collinear points is .....

(a) zero (b) 1 (c) 3 (d) infinite.

(4) The volume of a regular quadrilateral pyramid whose base perimeter 36 cm. and its height 10 cm. equals ..... cm^3.

(a) 810 (b) 180 (c) 360 (d) 270

Second question *3 marks*

The base length of a regular quadrilateral pyramid is 18 cm. , its volume is 1296 cm^3. , Find its lateral height and its lateral area.

Third question *3 marks*

Find the radius length of the base of right circular cone whose total area 616π cm^2. and the length of its drawer is 30 cm.

Answer the following questions :

First question *4 marks* **1 mark for each item**

Choose the correct answer from those given :

(1) The centre of the circle : $x^2 + y^2 - 6x + 8y = \text{zero}$ is the point .....

(a) $(3 , -4)$ (b) $(4 , -3)$ (c) $(-3 , 4)$ (d) $(-4 , 3)$

(2) The circumference of a circle whose equation : $(x-3)^2 + (y+2)^2 = 25$ equals .....

(a) 2π (b) 3π (c) 10π (d) 25π

(3) The lateral area of a right cone whose base radius length 6 cm. and its height 8 cm. equals ..... cm^2.

(a) 60π (b) 28π (c) 40π (d) 48π

(4) The point which lies on the circle : $(x-2)^2 + y^2 = 13$

(a) $(2 , 3)$ (b) $(3 , -2)$ (c) $(2 , 5)$ (d) $(4 , 3)$

Second question *3 marks*

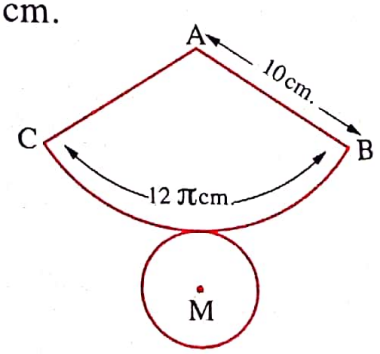
Find the general form of the circle whose centre $(-2 , 5)$ and passes through $(3 , 2)$

Third question *3 marks*

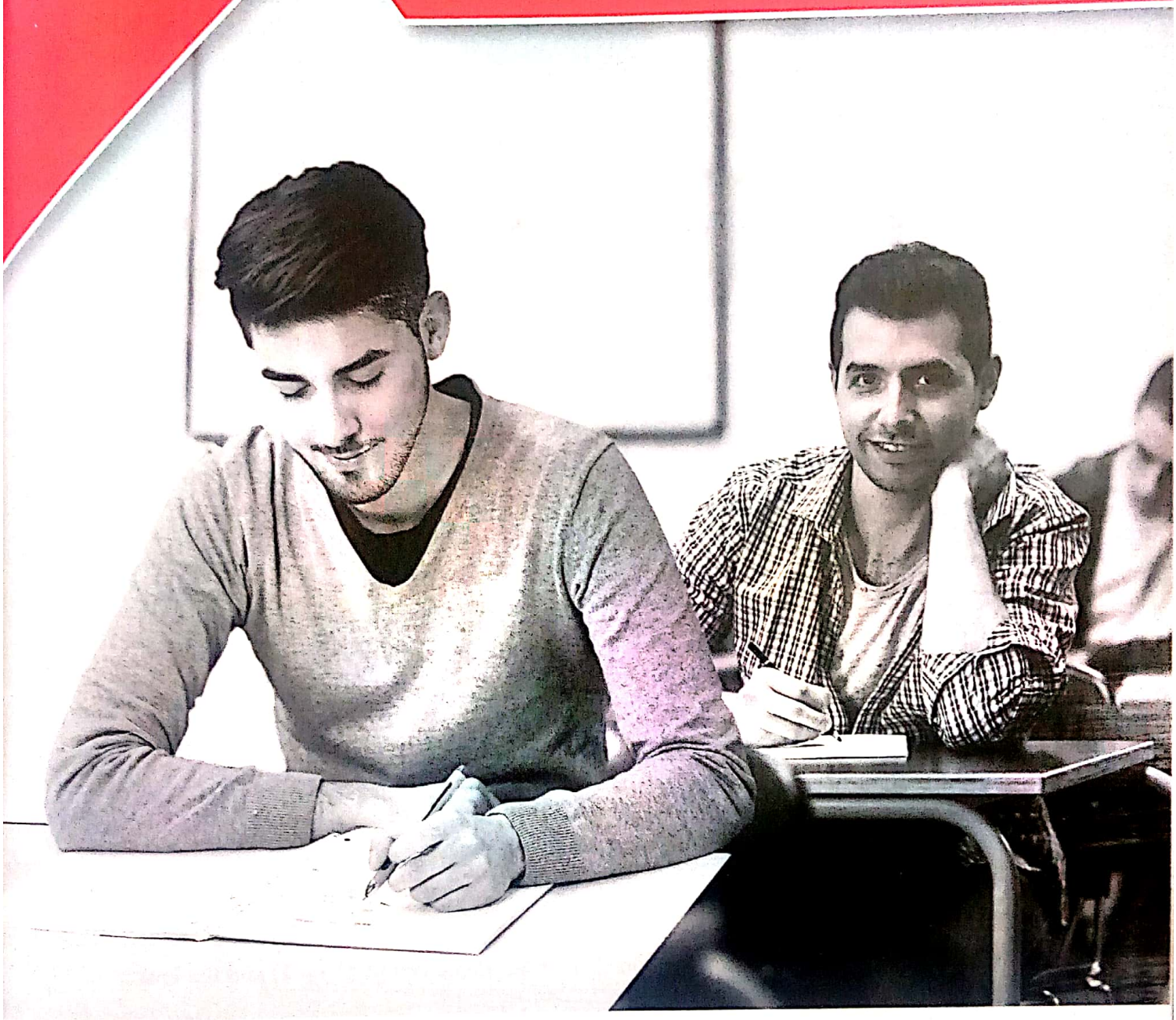
The opposite figure represents the net of a solid where $\overset{\frown}{BC} = 12\pi$ cm. , AB = 10 cm. , **calculate :**

(1) The total area of this solid.

(2) The volume of the solid.



School book examination



School book examination

The questions of the first term in the school book examinations are collected to form one test.

Answer the following questions :

1 **Choose the correct answer from the given ones :**

(1) Two forces of magnitude 3 F , 2 F and the magnitude of their resultant is 5 F , then the measure of the angle enclosed between the two forces equals .....

(a) zero° (b) 60° (c) 20° (d) 180°

(2) All of the following cases form a plane except .....

(a) a straight line and a point do not belong to it.

(b) two different parallel straight lines.

(c) two intersected straight lines.

(d) two skew straight ines.

(3) The point that lies on the circle $(x-2)^2 + y^2 = 13$ .....

(a) (2 , 3) (b) (3 , – 2) (c) (2 , 5) (d) (4 , 3)

(4) Two forces of magnitudes 5 , 3 newton and the measure of the angle enclosed between them is 60° , then the magnitude of their resultant R equals .....

(a) 2 (b) 7 (c) 8 (d) 5

---

2 **(a)** If the three coplanar forces $\vec{F}_1 = 5\vec{i} + 3\vec{j}$, $\vec{F}_2 = a\vec{i} + 6\vec{j}$, $\vec{F}_3 = -14\vec{i} + b\vec{j}$ act at a point and their resultant $\vec{R} = \left(10\sqrt{2} , \frac{3}{4}\pi\right)$ Find the values of a and b

(b) A body of weight 300 gm.wt. is placed on a smooth plane inclined to the horizontal with an angle whose tangent equals $\frac{1}{\sqrt{3}}$ the body is prevented from sliding by a force form with the line of the greatest slope an angle of measure 30° upwards. Find the magnitude of the force and the reaction of the plane.

---

3 **(a)** Find the general form of the equation of a circle whose centre (2 , – 1) and the length of its radius is 3 cm.

(b) A uniform smooth sphere of weight 10 gm.wt. and radius length 30 cm. is hanged from a point on its surface by a light string of length 30 cm. and the other end of the string is fixed in a point on a vertical smooth wall. **Find in the case of equilibrium each of :**

(1) The tension in the string. (2) The reaction of the wall on the sphere.

4 **(a)** A cube of wax with edge length 30 cm. transfer into a right circular cone of height 45 cm. Find the length of the radius of the base of the cone, if 8 % of the wax loss during milting and transferring processes.

(b) A uniform rod of length 100 cm. and weight 150 gm.wt. is suspended freely from its ends by two strings and the other ends of the strings are fixed in one point. If the lengths of the two strings are 80 cm. , 60 cm. , find the tension in the two strings.

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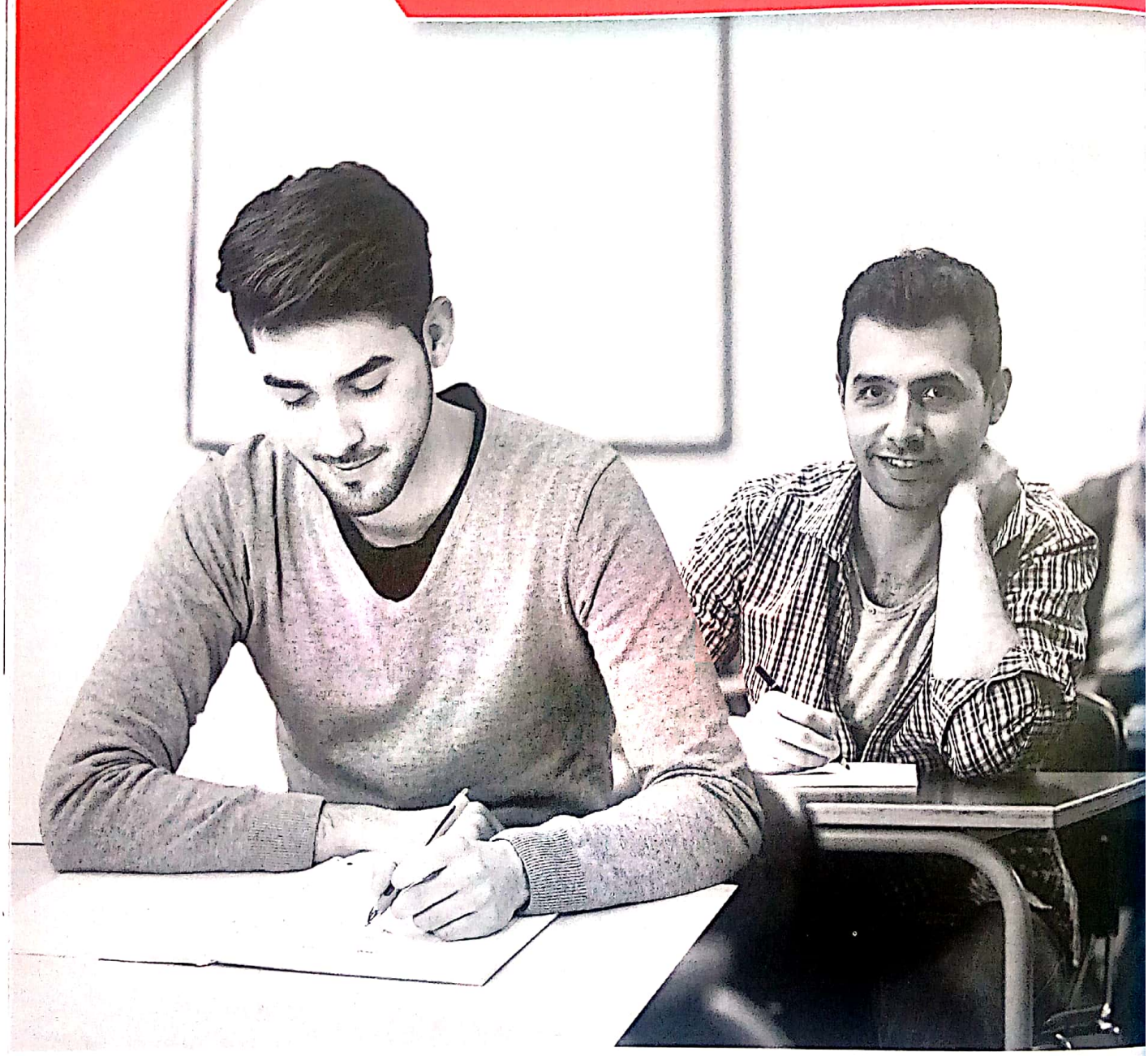
5 **(a)** ABCDEF is a uniform hexagon , the forces of magnitudes 8 , $6\sqrt{3}$, 5 and $4\sqrt{3}$ newton act on $\overrightarrow{AB}$, $\overrightarrow{AC}$, $\overrightarrow{AD}$, $\overrightarrow{AE}$ respectively. Find the magnitude and the direction of their resultant.

(b) $\overline{AB}$ is a uniform rod with length 40 cm. and weight 30 newton is attached with a vertical wall by a hinge at A , the rod is kept in equilibrium horizontally by a mean of a light string connected by its ends with the rod at B and with the vertical wall at the point C above A by 40 cm. Find the magnitude of the tension in the string and the reaction of the hinge at A

Final examinations



- 10 Examination models.
- 10 interactive examination models using the technique of QR Code.

Model 1

Interactive test 1

Answer the following questions :

1 The total surface area of a right circular cone which its drawer length equal the diameter length of its base is .....

(a) $4\pi r^2$ (b) $3\pi r^2$ (c) $3\pi r^3$ (d) $4\pi r^3$

2 If A , B and C are three points identify a plane , then .....

(a) AB = BC = CA (b) AB + BC = AC

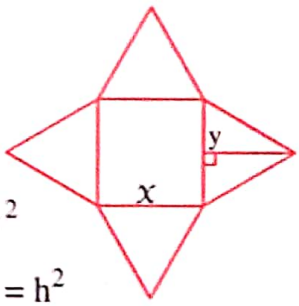
(c) AB + BC > AC (d) AB + BC < AC

3 Two forces are equal act at a point and the measure of the angle between them is $\frac{\pi}{3}$ and their resultant is 3 newton , then the magnitude of each is ..... newton.

(a) $\sqrt{3}$ (b) 3 (c) $\frac{3}{2}$ (d) $3\sqrt{3}$

4 **In the opposite figure :**

Represents a regular quadrilateral pyramid its height (h) , then the relation between x_1 y_2 and h is .....

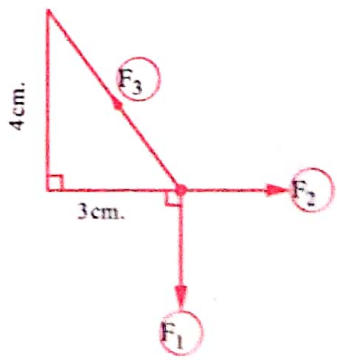


(a) $x^2 + y^2 = h^2$ (b) $x^2 + h^2 = y^2$

(c) $\left(\frac{x}{2}\right)^2 + h^2 = y^2$ (d) $\left(\frac{x}{2}\right)^2 + y^2 = h^2$

5 **In the opposite figure :**

A body is in equilibrium under the action of three forces meeting at a point of magnitudes F_1 , F_2 and F_3 newton , and the sides of the right-angled triangle are parallel to the lines of action of the forces in the same cyclic order , then $F_1 : F_2 : F_3$ = ...



(a) 3 : 4 : 5 (b) 3 : 5 : 4

(c) 4 : 5 : 3 (d) 4 : 3 : 5

6 ABCDHE is a regular hexagon. Forces of magnitudes 2 , $4\sqrt{3}$, 8 , $2\sqrt{3}$ and 4 kg.wt. act at point A in directions $\overrightarrow{AB}$, $\overrightarrow{AC}$, $\overrightarrow{AD}$, $\overrightarrow{AH}$, $\overrightarrow{AE}$ respectively.
Find the magnitude and the direction of their resultant.

7 Volume of a regular quadrilateral pyramid is 400 cm^3 and its height is 12 cm. , then its lateral surface area = ... cm^2

(a) 240 (b) 260 (c) 300 (d) 360

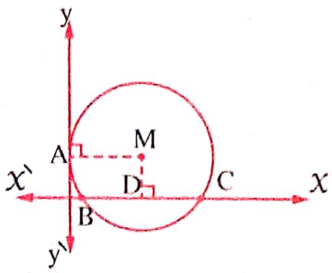
8 The area of base of a right circular cone is 36π cm^2 and the length of its drawer is 10 cm. , **find its :**

(1) Lateral surface area. (2) Total surface area.

(3) Volume.

9 **In the opposite figure :**

If B (2 , 0) , C (8 , 0) , then the equation of the circle is .....



(a) $(X-5)^2+(y-4)^2=25$

(b) $(X+5)^2+(y-4)^2=36$

(c) $(X-5)^2+(y-4)^2=36$

(d) $(X+5)^2+(y-4)^2=25$

10 Two forces of magnitude 6 , F kg.wt. act at a point and measure of the angle between them 135° , if its line of action inclined by an angle 45° , with the line of action of the force F , the magnitude of the resultant = ... kg.wt.

(a) 6 (b) $6\sqrt{2}$ (c) $6\sqrt{3}$ (d) 10

11 A body of weight (W) newton is placed on a smooth plane inclined with the horizontal at an angle of measure 30° and kept in equilibrium by the effect of force of magnitude 36 newton acts in the direction of the line of greatest slope of the plane upwards.
Find the magnitude of the weight W and the magnitude of the reaction of the plane.

12 If $\overrightarrow{R}$ is the resultant of the two forces $\overrightarrow{F_1}$, $\overrightarrow{F_2}$ and $\overrightarrow{\acute{R}}$ is the resultant of the two forces $\overrightarrow{F_1}$, $-\overrightarrow{F_2}$, then .....

(a) $\overrightarrow{R} + \overrightarrow{\acute{R}} = 2\overrightarrow{F_1}$

(b) $\overrightarrow{R} = \overrightarrow{\acute{R}} + 2\overrightarrow{F_2}$

(c) $R^2 + \acute{R}^2 = 2(F_1^2 + F_2^2)$

(d) all of previous.

13 **Find the equation of the circle which it is the image of the circle :**
$x^2 + y^2 - 12x + 6y + 20 = 0$ by translation $(x + 2 , y - 2)$

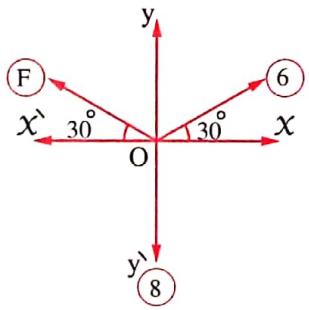
14 A force of magnitude $5\sqrt{3}$ newton act in direction 30° east of north , is resolved into two perpendicular components , then the magnitude of its component in direction the east = ...

(a) 5 (b) 7.5 (c) $\frac{5\sqrt{3}}{2}$ (d) 15

15 $\overline{AB}$ is a uniform rod of weight 20 kg.wt. the end A attached to a hinge fixed on a vertical wall a horizontal force F acts at B , the body is an equilibrium when it inclined by angle 30° with vertical , find the magnitude of each the force and reaction of the hinge.

16 **In the opposite figure :**

If the resultant of the forces (in newton) act along y-axis , then F : ..... newton.



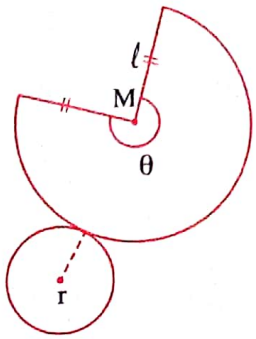
(a) 8 (b) 6

(c) 14 (d) 2

17 A cube made of wax , its edge length = 20 cm. it is melted and converted to a right circular cone of height 21 cm. Find the radius length of the base of the cone given that 12% from wax had been lost during melting and reforming. $\left(\pi \simeq \frac{22}{7}\right)$

18 **In the opposite figure :**

Represents net of a cone where the central angle of its circular sector = θ , $180° < \theta < 360°$, then .....



(a) $\ell < 2r$ (b) $\ell = r$

(c) $\ell = 2r$ (d) $\ell > 2r$

19 Which of the following system of forces can not be equilibrium ?

(a) 10 newton , 10 newton , 5 newton. (b) 4 newton , 6 newton , 8 newton.

(c) 11 newton , 7 newton , 8 newton. (d) 8 newton , 4 newton , 14 newton.

20 If the equation $(x \quad y \quad 25)\begin{pmatrix} x \\ y \\ -4 \end{pmatrix} = \square$ represents a circle , then the length of its diameter ..... length unit.

(a) 10 (b) 20 (c) 100 (d) 200

Model 2

Interactive test 2

Answer the following questions :

1. Any three points are non-collinear identify .....
   (a) one plane. (b) two planes. (c) 3 planes. (d) 4 planes.

2. When the two forces 6 and 8 newtons are perpindicular , then the sine of inclinition of the resultant with the first force equals .....
   (a) $\frac{3}{5}$ (b) $\frac{4}{5}$ (c) $\frac{3}{4}$ (d) $\frac{4}{3}$

3. The centre of the circle : $x^2 + y^2 - 6x + 8y = 0$ is the point .....
   (a) $(3 , -4)$ (b) $(-4 , 3)$ (c) $(-3 , 4)$ (d) $(-3 , -4)$

4. Three forces are equal in magnitude and meeting at a point are in equilibrium , then the measure of the angle between any two of them is .....
   (a) 60° (b) 120° (c) 90° (d) 150°

5. The volume of the right cone , the circumference of its base is 44 cm. and its height is 15 cm. equals ..... cm^3. $\left(\pi \simeq \frac{22}{7}\right)$
   (a) 77 (b) 105 (c) 110 (d) 770

6. Two forces of equal magnitude meeting at a point and the magnitude of their resultant equals 12 kg.wt. if the direction of one of them is reversed then the magnitude of the resultant becomes 6 kg.wt. Find the magnitude of each force.

7. The forces of magnitudes 2 F , 3 F and 4 F newton act on a particle in the directions parallel to the sides of an equilateral triangle in the same cyclic order.
   Find the magnitude and the direction of the resultant of these forces.

8 ABCDEF is a regular hexagon , the force of magnitude 20 newton acts along $\overrightarrow{AD}$, is resolved into two components in directions $\overrightarrow{AC}$, $\overrightarrow{AF}$, then the component in direction $\overrightarrow{AF}$ equals ..... newton.

(a) 10 (b) $10\sqrt{3}$ (c) 20 (d) $20\sqrt{3}$

9 Find the equation of the circle which its centre is $(2 , -3)$ and touches the straight line which its equation is : $3x - 4y + 2 = 0$

10 If the length of the base side of a regular quadrilateril pyramid is doubled , then its volume .....

(a) will doubled. (b) will be three times.

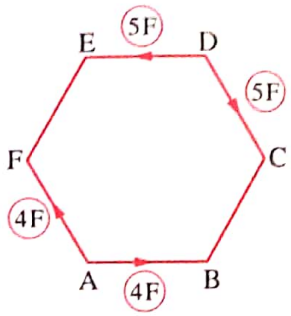
(c) will be four times. (d) will not change.

11 **In the opposite figure :**

ABCDEF is a regular hexagon , then the resultant of this forces should be in direction .....

(a) $\overrightarrow{AD}$ (b) $\overrightarrow{DA}$

(c) $\overrightarrow{AC}$ (d) $\overrightarrow{EA}$



12 A regular quadrilateral pyramid , the side length of its base = 40 cm. , and its lateral height is 25 cm. , **find :**

(1) Height of the pyramid. (2) The lateral surface area.

(3) The total surface area. (4) Its volume.

13 If $\overrightarrow{F_1} = 5\hat{i} - 3\hat{j}$, $\overrightarrow{F_2} = -7\hat{i} + 2\hat{j}$, $\overrightarrow{F_3} = 2\hat{i} + \hat{j}$, then $\overrightarrow{R}$ = ...

(a) $7\hat{i} - 2\hat{j}$ (b) $14\hat{i} - 4\hat{j}$ (c) $-14\hat{i} + 4\hat{j}$ (d) $\vec{0}$

14 The ball of a pendulum of weight 600 gm.wt. is displaced unitl the string makes an angle of measure 30° with the vertical under the action of a force perpendicular to the string. Find the magnitude of each of the force and the tension in the string.

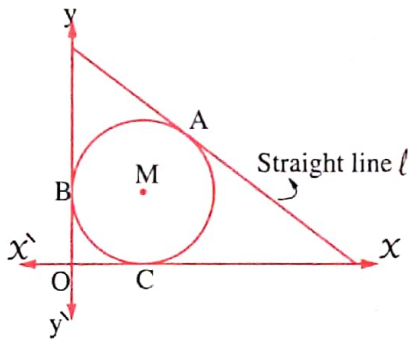
15 Two forces F , F act at a particle and the magnitude of their resultant is F , then the measure of the included angle of the two forces = ...

(a) 60° (b) 45° (c) 120° (d) 135°

16 A circular sector made of paper its radius length is 36 cm. and its central angle is 210° , folded to a right circular cone , find its height.

17 **In the opposite figure :**

If the equation of the straight line ℓ is $\frac{x}{8} + \frac{y}{6} = 1$, then the equation of the circle is .....



(a) $(x-2)^2 + (y-2)^2 = 4$

(b) $(x-2)^2 + (y-2)^2 = 16$

(c) $(x+2)^2 + (y+2)^2 = 4$

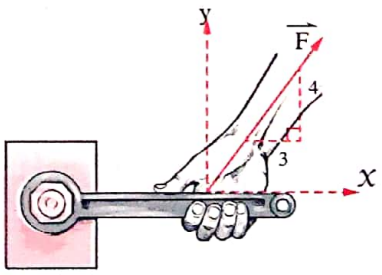
(d) $(x+2)^2 + (y+2)^2 = 16$

18 The ratio between volume of a regular triangular pyramid and volume of greatest cone can put it inside the pyramid equals .....

(a) $\frac{3\sqrt{3}}{\pi}$ (b) $\frac{3\sqrt{3}}{2\pi}$ (c) $\frac{\sqrt{3}}{\pi}$ (d) $\frac{3\sqrt{3}}{4\pi}$

19 **In the opposite figure :**

If vertical component of the force $(\vec{F})$ of a person uses a spanner is 60 newton , then the horizontal component of $\vec{F}$ equals ..... newton.



(a) 30 (b) 45

(c) 60 (d) 75

Model 3

Interactive test 3

Answer the following questions :

1. Two forces magnitudes 5 , 3 newton and the measure of the angle enclosed between them is 60° , then the magnitude of their resultant $\mathbb{R}$ equals .....

(a) 2 (b) 7 (c) 8 (d) 5

2. The height of a right circular cone is 12 cm. and the length of its drawer is 15 cm. , then its volume = ... cm^3

(a) 324π (b) 715π (c) 32π (d) 180π

3. The minimum value of resultant of two forces of magnitudes 5 , 9 newton and meeting at a point equals ..... newton.

(a) zero (b) 9 (c) 4 (d) 5

4. The least number of planes can determine a solid is ..... planes.

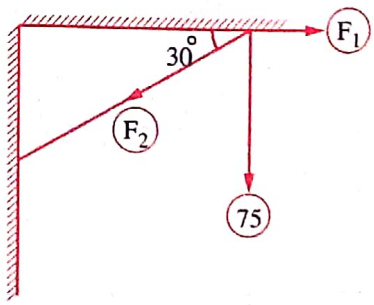
(a) three. (b) four. (c) two. (d) five.

5. A weight of magnitude 200 gm.wt. is suspended by two strings of lengths 60 cm. and 80 cm. , from two points on one horizontal line where the distance between them is 100 cm. Find the magnitude of tension in each string.

6. Calculate the volume of a regular quadrilateral pyramid , the length of side of its base = 18 cm. and the lateral height is 15 cm.

7. **In the opposite figure :**

A vertical force of magnitude is resolved into two components , one of them is horizontal (F_1) and the other F_2 , then F_2 = ... newton.



(a) 75 (b) $75\sqrt{3}$

(c) 150 (d) $150\sqrt{3}$

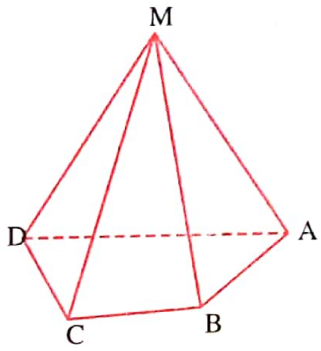
8 Two forces of magnitudes 6 , 12 newton act at a particle , enclosed between them an angle of measure 120° , find their resultant and measure of the angle which it makes with the first forces.

9 **In the opposite figure :**

The plane ABD ∩ the plane MCD = ...

(a) $\overleftrightarrow{AM}$ (b) $\overleftrightarrow{CD}$

(c) {D} (d) $\overleftrightarrow{MC}$



10 The forces 8 , $4\sqrt{3}$, $6\sqrt{3}$ and 14 newton act at a point , the measure of the angle between the first force and the second force is 30° , between the second and the third is 120° and between the third and the fourth is 90° taken in the same cyclic order. Find the magnitude and direction of the resultant of these forces.

11 If the geometric centre of a regular hexagon is the origin and its area = $3\sqrt{3}$ cm^2 , then the equation of its circumcircle is .....

(a) $x^2 + y^2 = 2$ (b) $x^2 + y^2 = 4$

(c) $x^2 + y^2 = 6$ (d) $x^2 + y^2 = 8$

12 **In the opposite figure :**

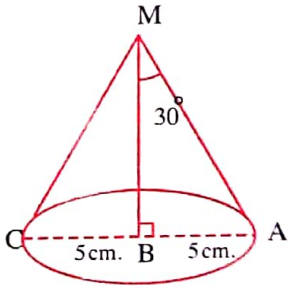
A right circular cone in which m (∠ AMB) = 30°

, the radius length of the base = 5 cm.

, then its total area = ... cm^2

(a) 50 π (b) 75 π

(c) 100 π (d) 125 π



13 Two forces of magnitudes 6 , 2.5 newton the magnitude of their resultant = 6.5 newton , then measure of the included angle of the two forces is .....

(a) acute. (b) obtuse. (c) right. (d) straight.

14 A body of weight 100 newton is placed on a smooth plane inclines to the horizontal by an angle $30°$, the body kept in equilibrium by a horizontal force.
Find the magnitude of this force and the reaction of the plane on the body.

15 In a trianglular pyramid of regular faces , if the sum of lengths of its edges = 36 cm. , then the height of the pyramid = ... cm.

(a) $\sqrt{6}$ (b) $2\sqrt{6}$ (c) 6 (d) 4

16 **Prove that the two circles :**

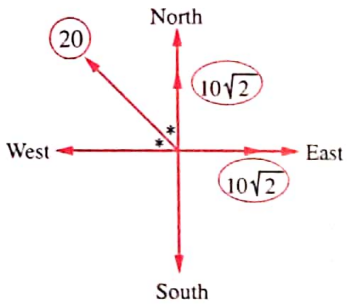
$x^2 + y^2 - 2x + 6y + 1 = 0$, $4x^2 + 4y^2 - 8x + 24y + 15 = 0$

are concentric circles , and find length of radius of each of them.

17 **In the opposite figure :**

The resultant of the forces $10\sqrt{2}$, $10\sqrt{2}$, 20 newton acts in direction .....

(a) the eastern north. (b) the north.
(c) the western north. (d) the western south.



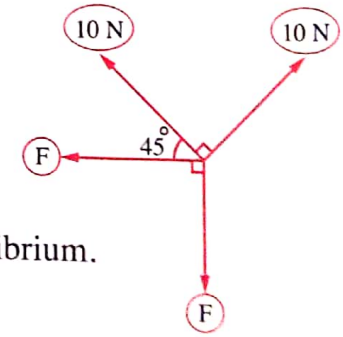
18 If the volume of hemisphere of radius length "r" equals the volume of a cone the length of radius of its base = r and its height = h the .....

(a) $h = \frac{2}{3} r$ (b) $h = 2r$ (c) $h = 2r^2$ (d) $h = 4r$

19 **In the opposite figure :**

The condition of equilibrium of the given forces is .....

(a) F = 10 newton. (b) $F = 10\sqrt{2}$ newton.
(c) $F = 5\sqrt{2}$ newton. (d) the system will not be equilibrium.



7 A right circle cone , its base on the coordinate plane with equation $x^2 + y^2 = 36$ if the height of the cone = 8 length unit , **find :**

(1) Volume of the cone. (2) Total surface area.

8 The equation $(x \quad y \quad 8)\begin{pmatrix} x \\ y \\ -2 \end{pmatrix} = \square$ represents a circle its diameter length = ... length unit.

(a) 2 (b) 4 (c) 6 (d) 8

9 Two forces of magnitudes 4 , F newton act at a particle , the measure of included angle is 120° , if line action of the resultant is perpendicular to the first force , then magnitude of the resultant = ... newton.

(a) $4\sqrt{2}$ (b) $4\sqrt{3}$ (c) 4 (d) $4\sqrt{5}$

10 A body of weight (W) newton is suspended by two light strings inclined to the vertical by angles θ° and 30° the body becomes equilibrium when the tension of the first string equal 12 newton. and the other is $12\sqrt{3}$ newton , find θ° and the magnitude of W

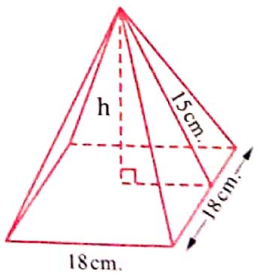
11 If $\overrightarrow{F_1}$, $\overrightarrow{F_2}$ are two forces , then the measure of the angle enclosed between $\overrightarrow{F_1}$ and the resultant of the two forces $(\overrightarrow{F_1} + \overrightarrow{F_2})$, $(\overrightarrow{F_1} - \overrightarrow{F_2})$ equals .....

(a) zero. (b) $\tan^{-1}\left(\frac{F_1}{F_2}\right)$

(c) $\tan^{-1}\left(\frac{F_2}{F_1}\right)$ (d) $\tan^{-1}\left(\frac{F_1 - F_1}{F_1 + F_2}\right)$

12 **In the opposite figure :**

Calculate the volume of the regular quadrilateral pyramid which it the side length of its base = 18 cm. and the lateral height = 15 cm.



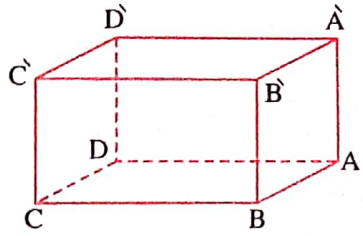
13 Find the equation of the circle which passes through the two points (1 , 3) , (2 , – 4) and its centre lies on x-axis.

14 **In the opposite figure :**

The plane $A\grave{A}\grave{B} \cap$ the plane $\grave{A}C\grave{C}$ = ...

(a) $\overleftrightarrow{A\grave{A}}$ (b) $\overleftrightarrow{B\grave{B}}$

(c) $\overleftrightarrow{C\grave{C}}$ (d) $\overleftrightarrow{\grave{A}C}$

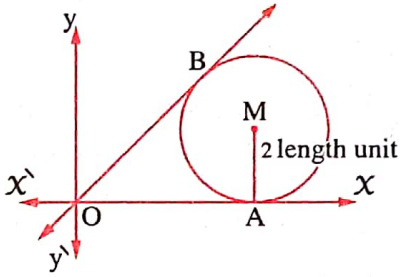


15 **In the opposite figure :**

If OB = 5 length unit , then the equation of the circle M is .....

(a) $(x-2)^2+(y-5)^2=25$ (b) $(x-2)^2+(y-5)^2=4$

(c) $(x-5)^2+(y-2)^2=25$ (d) $(x-5)^2+(y-2)^2=4$

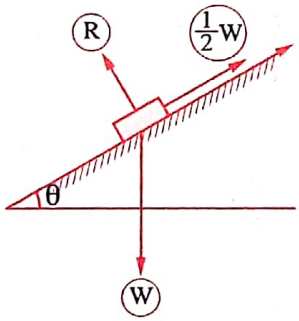


16 **In the opposite figure :**

If the body is in equilibrium under acting of the shown forces , then m ($\angle\theta$) = ...

(a) 30° (b) 60°

(c) 45° (d) 15°



17 The radius length of the base of a right circular cone = 5 cm. and its total surface area = 90 π cm^2 , then its volume = ... cm^3

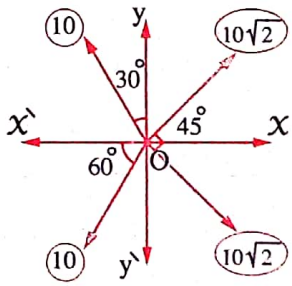
(a) 105 π (b) 95 π (c) 100 π (d) 120 π

18 **In the opposite figure :**

The resultant of the system of forces "R" = ... newton.

(a) 20 (b) $10\sqrt{2}$

(c) 10 (d) zero.



19 The equation $\begin{vmatrix} x & -y \\ y & x \end{vmatrix}$ = 36 represents the equation of a circle with radius length = ... length unit.

(a) 3 (b) 6 (c) 9 (d) 18

Model 5

Interactive test 5

Answer the following questions :

1. The two straight lines be skew if they are .....
   (a) not parallel. (b) not intersecting.
   (c) not coincident. (d) not contained in the same plane.

2. The lateral surface area of a right circular cone , radius length of its base = 6 cm. and its height = 8 cm. equals ..... cm^2.
   (a) 60π (b) 28π (c) 10π (d) 48π

3. Two forces of magnitudes 5 F , 2 F and their resultant is 7 F newton , then the measure of the angle between them = ...
   (a) 180° (b) 60° (c) 20° (d) zero.

4. If $\vec{F}$ be equilibrium with two perpendicular forces of magnitudes 8 newton , 15 newton , then F = ... newton.
   (a) 7 (b) 17 (c) 23 (d) $7\sqrt{2}$

5. If the three coplanar forces $\vec{F_1} = 5\hat{i} + 3\hat{j}$, $\vec{F_2} = a\hat{i} + 6\hat{j}$, $\vec{F_3} = -14\hat{i} + b\hat{j}$ act at a point and their resultant $\vec{R} = \left(10\sqrt{2} , \frac{3}{4}\pi\right)$, then a + b = ...
   (a) – 1 (b) 1 (c) zero. (d) 14

6. The total surface area of a right circular cone is 96π cm^2 , the length of its drawn is 10 cm. Find the radius length of its base and its volume.

7. A homogeneous smooth sphere its radius length is 10 cm. , its weight = 30 gm.wt. is in equilibrium by a string of length 10 cm. attached to a point of its surface and the other end of the string is fixed at the point in vertical smooth wall , find the tension of the string and the reaction of the wall on the sphere.

8. Prove that the total surface area of a triangular regular faces pyramid which its edge length = ℓ cm. is equal to $\sqrt{3}\,\ell^2$ cm^2.

9 The area of any of the lateral faces of a regular quadrilateral pyramid equals to the area of its base , if side length of its base = 6 cm. , then its volume = ... cm^3

(a) 36 (b) $6\sqrt{3}$ (c) $36\sqrt{15}$ (d) $216\sqrt{15}$

10 ABCD is a square of side length = 10 cm. , E is midpoint of $\overline{AB}$, forces of magniutdes 2 , $7\sqrt{5}$, $4\sqrt{2}$ and 4 newton in directions $\overrightarrow{CB}$, $\overrightarrow{CE}$, $\overrightarrow{CA}$ and $\overrightarrow{CD}$ respectively , find magnitude and direction of resultant of this forces.

11 Two forces of magnitude F , $F\sqrt{3}$ newton , meeting at a point and magnitude of their resultant = R_1 when the measure of included angle = 90° and the resultant became R_2 when the measure of the included angle = 150° , then .....

(a) $R_1 = R_2$ (b) $R_1 = 2\,R_2$ (c) $R_1 = \frac{3}{5}\,R_2$ (d) $R_1 = \frac{1}{2}\,R_2$

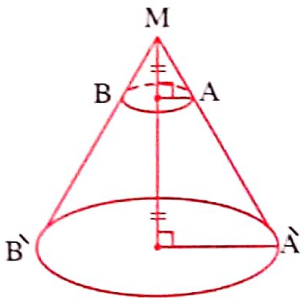
12 Write the general form of the circle which its diameter $\overline{AB}$, where A (2 , 3) , B (– 4 , 9)

13 Two force F_1 , F_2 has maximum value of their resultant is 25 newton and minimum value of their resultant is 13 newton , **find :** F_1 , F_2 for all $F_1 > F_2$

14 **In the opposite figure :**

The ratio between the lateral surface area of the cone MAB to the lateral surface area of the cone $M\grave{A}\grave{B}$ equals .....

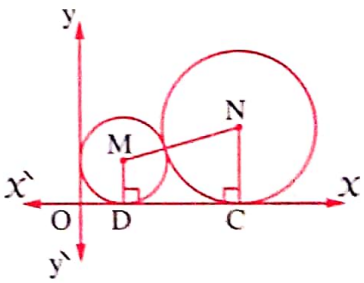
(a) 1 : 2 (b) 1 : 4
(c) 1 : 6 (d) 1 : 8



15 **In the opposite figure :**

M , N are two circle touching externally their equations are $(x - 2)^2 + (y - 2)^2 = 4$ and $(x - a)^2 + (y - b)^2 = 64$, then a + b = ...

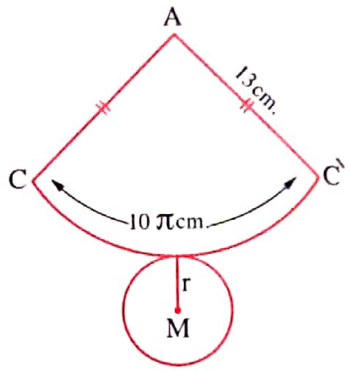
(a) 8 (b) 10
(c) 18 (d) 28



16 **In the opposite figure :**

Net of a solid

, its volume = ... cm^3.



(a) 25 π (b) 50 π

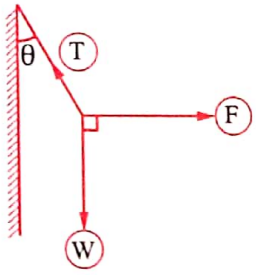
(c) 75 π (d) 100 π

17 A force of magnitude 40 newton acts vertically upwords was resolved into two components one of them is horizontal and its magnitude 20 newton , then the magnitude of the other = ... newton.

(a) 20 (b) $20\sqrt{2}$ (c) 10 (d) $20\sqrt{5}$

18 **In the opposite figure :**

A weight of magnitude W newton is suspended in one end of a string and the other end of the string fixed in a point on a vertical wall , the weight is pulled by a horizontal force of magnitude F newton till the string become makes an angle θ with vertical.



Which of the following statements is not correct in equilibrium state ?

(a) $F = W \tan\theta$ (b) $\vec{W} + \vec{F} + \vec{T} = \vec{O}$

(c) $T^2 = F^2 + W^2$ (d) $T = F + W$

Model 6

Interactive test 6

Answer the following questions :

1 The lateral surface area of right cone , which the radius length of its base is r , and length of its drawer ℓ equals .....

(a) $2\pi\ell r$ (b) $2\pi\ell r^2$ (c) $\pi\ell r$ (d) $\pi\ell r^2$

2 Which two forces from the following pairs , could not have resultant with magnitude = 4 newton ?

(a) 2 newton , 4 newton
(b) 3 newton , 3 newton
(c) 2 newton , 6 newton
(d) 3 newton , 8 newton

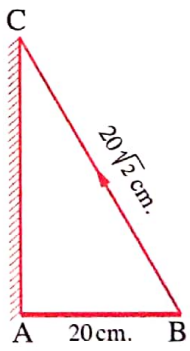
3 The point which lies on the circle $(x-2)^2 + y^2 = 13$ is .....

(a) (2 , 3) (b) (3 , – 2) (c) (2 , 5) (d) (4 , 3)

4 Number of planes which carry faces of pentagon pyramid is .....

(a) 5 (b) 6 (c) 10 (d) infinite.

5 $\overline{AB}$ is a uniform rod with length 20 cm. and its weight = 30 newton attached by a smooth hinge fixed on a vertical wall in the end A and at the end B suspended by a light string with length $20\sqrt{2}$ cm. its other end fixed at point C on the wall above point A if the rod in equilibrium in the horizontal position then the reaction of the hinge .....



(a) act in direction $\overrightarrow{AB}$
(b) its line of action distant 10 cm. from the wall.
(c) bisects $\overline{BC}$
(d) is of magnitude = 15 newton.

6 A body of weight 340 gm.wt. is suspended by two strings with lengths 16 cm. , 30 cm. from two points on same horizontal line , the distance between them 34 cm. , find the magnitude of the tension of each of the two strings.

7 The general form of the equation of circle its centre is $(5 , -4)$ and touches x-axis is .....

(a) $x^2 + y^2 - 10x + 8y + 25 = 0$ (b) $x^2 + y^2 - 5x + 4y = 0$

(c) $x^2 + y^2 - 10x + 8y = 25$ (d) $x^2 + y^2 + 10x - 8y + 25 = 0$

8 A uniform rod of length 100 cm. , and its weight 150 gm.wt. is suspended from its ends by two strings , the other end of each string fixed on a same point , it the lengths of the two strings are 80 cm. , 60 cm. , then find the magnitude of the tension of each of them.

9 If $\overrightarrow{R}$ is the resultant of $\overrightarrow{F_1}$, $\overrightarrow{F_2}$, $\overrightarrow{R} \perp \overrightarrow{F_1}$ and $R = \frac{1}{2} F_2$, then the measure of the angle between the two forces $\overrightarrow{F_1}$, $\overrightarrow{F_2}$ are .....

(a) 40° (b) 120° (c) 135° (d) 150°

10 A regular quadrilateral pyramid , the side length of its base 18 cm. If its volume is 1296 cm^3. , then find the lateral height and lateral surface area.

11 Three coplanar forces of magnitudes 60 , F and K newton meeting at a point and in equilibrium. If the angle between the 1st and the 2nd force measures 120° and between the 2nd and the 3rd measures 90° , then the value of K = ... newton.

(a) $30\sqrt{3}$ (b) $30\sqrt{2}$ (c) 30 (d) 60

12 A right cone of volume 27π cm^3. , circumference of its base 6π cm. , find its height.

13 The ratio between the lateral surface area of the triangular pyramid of regular faces to its total surface area = ...

(a) 1 : 3 (b) 1 : 4 (c) 3 : 4 (d) 1 : 2

14 ABCDEO is regular hexagon the forces of magnitudes 2 , $4\sqrt{3}$, 8 , $2\sqrt{3}$, 4 kg.wt. act at a point A in directions $\overrightarrow{AB}$, $\overrightarrow{AC}$, $\overrightarrow{DA}$, $\overrightarrow{AE}$, $\overrightarrow{AO}$ respectively.
Find magnitude and direction of the resultant of this forces.

15 The length of the tangent segment which drawn of the circle $x^2 + y^2 = r^2$ from the point $(0 , 2r)$ is .....

(a) r (b) $2r$ (c) $\sqrt{3}\,r$ (d) $\frac{\sqrt{3}}{2}r$

16 ABC is an isosceles triangle where AB = AC = 10 cm. , BC = 12 cm. , rotates a complete revolution about $\overline{BC}$, calculate the volume of the solid which generated by rotation.

17 ABCD $\grave{A}\grave{B}\grave{C}\grave{D}$ is a cube of edge length = 20 cm. a right circular cone is put inside the cube such that the vertex of the cone is the centre of cube base $\grave{A}\grave{B}\grave{C}\grave{D}$, and base of the cone touches the sides of the base ABCD , then the ratio between volume of each the cone and cube is .....

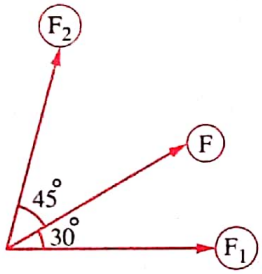
(a) $\frac{\pi}{12}$ (b) $\frac{\pi}{3}$ (c) $\frac{1}{3}$ (d) $\frac{12}{\pi}$

18 **In the opposite figure :**

The force $\vec{F}$ is the resultant of the two forces $\vec{F_1}$, $\vec{F_2}$, then $\frac{F_1 + F_2}{F}$ = ...

(a) $\sin 30° + \sin 45°$ (b) $\frac{\sin 75° + \sin 30°}{\sin 75°}$

(c) $\frac{\sin 45° + \sin 30°}{\sin 75°}$ (d) $\frac{\sin 75°}{\sin 30°} + \frac{\sin 75°}{\sin 45°}$



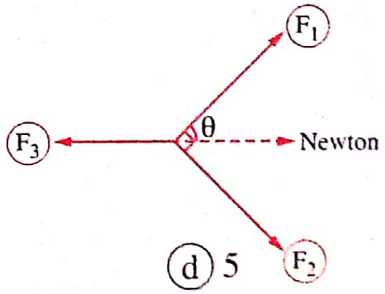
19 Two forces meeting at a point of magnitudes F_1 , F_2 where $0 \le F_1 \le 13$, $8 \le F_2 \le 17$, the measure of the included angle is 180° and magnitude of their resultant R , then .....

(a) $3 \le R \le 4$ (b) $0 \le R \le 4$ (c) $0 \le R \le 17$ (d) $5 \le R \le 17$

20 **In the opposite figure :**

Represents three forces $\vec{F_1}$, $\vec{F_2}$ and $\vec{F_3}$ of magnitudes 4 , 3 and 2 newton respectively , if $\sin\theta = \frac{3}{5}$, then magnitude of their resultant equals ..... newton.

(a) 1 (b) 2 (c) 3 (d) 5



Model 7

Interactive test 7

Answer the following questions :

1. If the resultant of two forces acting at a point reaches the maximum value , then the measure of the angle between their line of actions equals .....

(a) 180° (b) 120° (c) 0° (d) 60°

2. A regular quadrilateral pyramid , the side length at its base 10 cm. , and its lateral height 13 cm. , its lateral area = ... cm^2.

(a) 260 (b) 360 (c) 130 (d) 520

3. The centre of the circle $x^2 + y^2 - 6x + 8y = 0$ is the point .....

(a) (3 , – 4) (b) (4 , – 3) (c) (– 3 , 4) (d) (– 4 , 3)

4. If the forces $\overrightarrow{F_1}$, $\overrightarrow{F_2}$, $\overrightarrow{F_3}$ are three forces measured by newton are in equilibrium and meeting at a point and $\overrightarrow{F_1} = 2\hat{i} - 3\hat{j}$, $\overrightarrow{F_2} = 3\hat{i} + 5\hat{j}$, then $\overrightarrow{F_3}$ = ... newton.

(a) $5\hat{i} + 2\hat{j}$ (b) $-5\hat{i} - 2\hat{j}$ (c) $\sqrt{29}$ (d) $\sqrt{34}$

5. A body of weight W newton is placed on smooth inclined plane , where the angle of the inclination of the plane with the horizontal is 30° , the body kept in equilibrium by a force of magnitude 36 newton and acts in the direction of the line of greatest slope upward , calculate the magnitude of the weight and reaction of the plane.

6. The general form of the equation of the circle which its centre is (– 2 , 5) and passes through (3 , 2) is .....

(a) $x^2 + y^2 - 4x + 10y - 5 = 0$ (b) $x^2 + y^2 + 4x - 10y - 5 = 0$

(c) $x^2 + y^2 + 2x - 5y - 5 = 0$ (d) $x^2 + y^2 + 4x - 10y - 25 = 0$

7. If the straight line L // the plane X , $A \in X$, then $L \cap X$ = ...

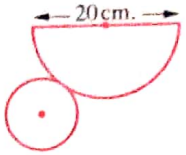
(a) $\varnothing$ (b) L (c) {A} (d) X

8 The lateral surface area of a regular quadrilateral pyramid 240 cm^2 , and its slant height is 12 cm. , **find :**

(1) Height of the pyramid.

(2) Volume of the pyramid.

9 If we folded the opposite net to become a cone , then the radius length of its base = ...



(a) 10 cm. (b) 8 cm. (c) 5 cm. (d) 2.5 cm.

10 A metal sphere of weight 400 kg.wt. act in its centre , placed between two smooth planes , one of them is vertical and the other inclined 60° with vertical , then find the reaction of each plane.

11 The volume of right cone , where the length of its drawer 15 cm. and the total surface area = 216 π cm^2 equals ..... cm^3

(a) 205 π (b) 320 π (c) 380 π (d) 324 π

12 If R is the resultant of the two forces F_1 , F_2 where $F_2 > F_1$, then which of the following conditions is enough to make $R \perp F_1$?

(a) $R^2 = F_1^2 + F_2^2$ (b) $R^2 = F_2^2 - F_1^2$

(c) $\overrightarrow{F_1} \perp \overrightarrow{F_2}$ (d) all of previous.

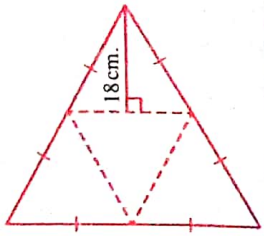
13 ABCD is a square of side length 12 cm. $H \in \overline{BC}$ where BH = 5 cm. forces of magnitudes 2 , 13 , $4\sqrt{2}$, 9 gm.wt. act in directions of $\overrightarrow{AB}$, $\overrightarrow{AH}$, $\overrightarrow{CA}$ and $\overrightarrow{AD}$ respectively. Find the resultant of these forces.

14 If $x^2 + y^2 + 2 (\cos \theta) x - 2 (\sin \theta) y - 8 = 0$ represents the equation of a circle , then r = ... length unit.

(a) $\sqrt{2}$ (b) $2\sqrt{2}$ (c) 3 (d) 8

15 Four coplanar forces of magnitudes F_1 , $6\sqrt{2}$, $8\sqrt{2}$, F_2 gm.wt. acting at a point in direction of east , the eastern north , western north and south respectively. If the resultant of this forces equal 7 gm.wt. and act in direction of east , then find F_1 , F_2

16 When we fold the opposite net , then what is the resulting solid and find its total surface area and its volume.



17 ABCDE is a regular pentagon , a force of magnitude 20 newton acts along $\overrightarrow{AC}$, then was resolved in two directions $\overrightarrow{AB}$ and $\overrightarrow{AE}$, then the magnitude of the component in direction $\overrightarrow{AB}$ equals ..... newton.

(a) 10 (b) 20 (c) $20\sqrt{3}$ (d) 12.4

18 The radius length of the base of a right circular cone is 15 cm. , and its height = 20 cm. , then its lateral area = ... cm^2

(a) 600π (b) 375π (c) 1875π (d) 5625π

Model 8

Interactive test 8

Answer the following questions :

1. Two forces of magnitudes 8 , F gm.wt. and the measure of the included angle $\in]0 , \pi[$, the line of action of their resultant bisects the included angle , then F = ... gm.wt.

(a) $2\sqrt{2}$ (b) 4 (c) 8 (d) 16

2. The volume of the regular quadrilateral pyramid , where the perimeter of its base = 36 cm. and its height 10 cm. is ..... cm^3.

(a) 810 (b) 180 (c) 360 (d) 270

3. The circumference of the circle which its equation is $x^2 + y^2 = 8$ is .....

(a) 8π (b) 64π (c) $2\sqrt{2}\pi$ (d) $4\sqrt{2}\pi$

4. If three forces meeting at a point and acting up on a particle are in equilibrium , then the magnitude of each force is proportional to the ..... of the included angle between the two other forces.

(a) cosine (b) sine (c) tangent (d) cotangent

5. Two forces are equal in magnitude and each of them equal F newton if the magnitude of the resultant is F newton , then the measure of the included angle = ...

(a) 0 (b) 30° (c) 60° (d) 120°

6. The volume of regular hexagon pyramid is $8\sqrt{3}$ cm^3 and its height is 4 cm. , find the perimeter of its base.

7. Force of magnitude $10\sqrt{2}$ gm.wt. acts in direction the eastern south , it was resolved into two perpendicular components , then the component in the south direction = ... gm.wt.

(a) $10\sqrt{3}$ (b) $10\sqrt{2}$ (c) 10 (d) 5

8 The general form of the equation of the circle where its centre is $(2 , -1)$ and radius length is 3 cm. is .....

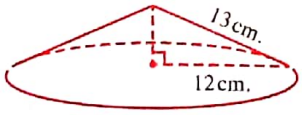
(a) $x^2 + y^2 - 4x + 2y - 4 = 0$ (b) $x^2 + y^2 - 2x + y - 4 = 0$

(c) $x^2 + y^2 + 4x - 2y - 4 = 0$ (d) $x^2 + y^2 - 4x + 2y - 16 = 0$

9 A body of weight 24 newton is suspended at one end of a string of length 130 cm. , the other end is fixed at a point of a vertical wall. A horizontal force acts on the body to become in equilibrium. Find the magnitudes of the force and the tension in the string. When the body is at a distance = 50 cm. from the wall.

10 **In the opposite figure :**

The central angle of the sector which if it is folded becomes this cone is .....



(a) a cute. (b) obtuse. (c) straight. (d) reflex.

11 The force of magnitudes F , 80 , K , 50 , $80\sqrt{3}$ newton act at a point in the direction of east , 30° east of north , north , west and south respectively.
Find the values of F and K if the resultant is 40 newton in magnitude in the direction of 60° north of east.

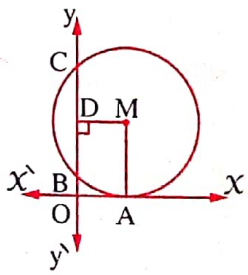
12 Number of the planes which passes through two given points is .....

(a) zero. (b) 1 (c) 2 (d) infinite.

13 A right circular cone , length of its drawer 17 cm. , and its height 15 cm. Find the total surface area and its volume.

14 **In the opposite figure :**

Circle M touches x-axis at A , OB = 2 length unit , BC = 6 length unit , then equation of the circle M is .....



(a) $(x + 4)^2 + (y + 5)^2 = 16$ (b) $(x - 4)^2 + (y - 5)^2 = 25$

(c) $(x - 4)^2 + (y - 5)^2 = 16$ (d) $(x + 4)^2 + (y + 5)^2 = 25$

15 A body of weight 6 kg.wt. is placed on a smooth plane inclines to the horizontal by an angle of measure 30° and kept in equilibrium by a horizontal force. Find the magnitude of each of the horizontal force and the reaction of the plane on the body.

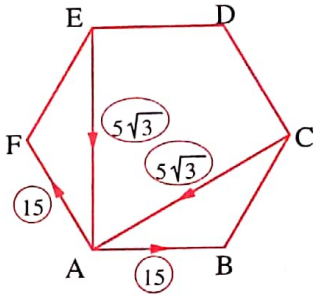
16 Find K which makes the two circle $C_1 : (x + 2)^2 + (y + 11)^2 = K$, $C_2 : (x - 3)^2 + (y - 1)^2 = 16$ are touching each other.

17 If the resultant of two perpendicular forces , inclined to the greatest one by angle of measure θ , then which of the following values is suitable value of θ ?

(a) 90° (b) 70° (c) 45° (d) 10°

18 **In the opposite figure :**

ABCDEF is a regular hexagon , forces of magnitudes 15 , $5\sqrt{3}$, $5\sqrt{3}$ and 15 act along $\overrightarrow{AB}$, $\overrightarrow{CA}$, $\overrightarrow{EA}$ and $\overrightarrow{AF}$, then the magnitude of the resultant R = ... newton.



(a) 5 (b) 10

(c) 25 (d) zero.

Model 9

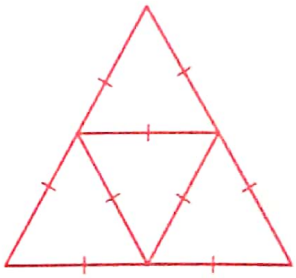
Interactive test 9

Answer the following questions :

1. Two perpendicular forces of magnitudes $2F - 5$, $F + 2$ newton act at a particle , the magnitude of their resultant is $3\sqrt{5}$ newton , then $F =$ .....

(a) 2 (b) 3 (c) 4 (d) 5

2. Which solid , its net is the opposite figure ?



(a) Quadrilateral pyramid.
(b) Regular quadrilateral pyramid.
(c) Triangular pyramid with regular faces.
(d) Otherwise.

3. Volume of right circular cone is 100 cm^3 , then its volume when its height is doubled becomes ..... cm^3

(a) 100 (b) 200 (c) 400 (d) 800

4. A body of weight 18 kg.wt. is placed on a smooth plane inclines to the horizontal at angle of measure 30° , the body kept in equilibrium by a force F inclines to line of greatest slope upward by an angle of measure 30° , find the magnitude of this force and the reaction of the plane on the body.

5. Force of magnitude $4\sqrt{2}$ acts in east direction it was resolved into two perpendicular component , then the magintude of the component in direction of eastern north equals ..... newton.

(a) 4 (b) $4\sqrt{2}$ (c) 8 (d) $8\sqrt{2}$

6. A regular quadrilateral pyramid. The perimeter of its base = 40 cm. and its height 12 cm. , then its surface area = ... cm^2

(a) 200 (b) 240 (c) 260 (d) 320

7 The equation of the circle which the straight line : $x + y = 2$ touches it , and its centre is $(3 , 5)$ is .....

(a) $(x-3)^2 + (y-5)^2 = 3\sqrt{2}$
(b) $(x+3)^2 + (y+5)^2 = 18$
(c) $(x-3)^2 + (y-5)^2 = 12$
(d) $(x-3)^2 + (y-5)^2 = 18$

8 A weight of 16 newton is suspended at the end of a light string and the other end is fixed at a point of a vertical wall. A force magnitude F acts on the weight in a perpendicular direction of the string till it become in equilibrium when the string is inclined to the wall with an angle of measure 30°
Find the magnitude of the force F and the tension of the string.

9 A uniform rod $\overline{AB}$ of length 6 metres and weight 8 kg.wt. is attached to a hinge fixed in a vertical wall at its end A The rod is kept horizontally by attaching it at a point C on the rod (where AC = 4 metres) by a string which its other end is fixed at the point D on the wall above A exactly and at a distance 4 metres from it. Calculate the magnitude of the tension in the string and the reaction of the hinge.

10 Write the equation of the circle which touch the x-axis at the point $(-2 , 0)$ and intersept from the positive part of y-axis a chord of length $4\sqrt{3}$ length unit.

11 Two forces are equal in magnitude and the magnitude of their resultant is 24 newton and the measure of the angle between the resultant and one of the two forces is 30° , then the magnitude of each of the two forces = ... newton.

(a) 8 (b) $8\sqrt{3}$ (c) $8\sqrt{2}$ (d) 12

12 A circular sector , the radius length of its circle is 18 cm. and the measure of its central angle = 60° , it is folded and their radii are connected to form greatest lateral area of a right circular cone. Find the volume of this cone.

13 The ratio between length of the edge of triangular pyramid of regular faces to its height = ...

(a) $\sqrt{2} : \sqrt{3}$ (b) $\sqrt{3} : 2$ (c) $\sqrt{6} : 2$ (d) $\sqrt{3} : 3$

14 Three forces of magnitudes 10 , 20 , 30 newton act at a particle , the first in direction of east and the second in direction of 30° west of north and third in direction of 60° south of west. Find the magnitude and direction of the resultant of this force.

15 Right circular cone , area of its base = 25 π cm^2 , length of its drawer = 13 cm. , then its lateral area = ... cm^2

(a) 50 π (b) 65 π (c) 90 π (d) 100 π

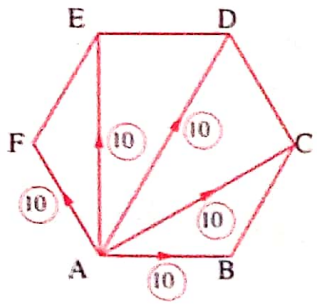
16 Two forces of magnitudes F , 2 F newton act at a particle , and the line of action of its resultant is perpendicular to one of the two forces , then the measure of the included angle between the two forces = ...

(a) 60° (b) 90° (c) 120° (d) 135°

17 The point which lies on the circle : $(x-2)^2 + y^2 = 13$ is .....

(a) (2 , 3) (b) (3 , – 2) (c) (2 , 5) (d) (4 , 3)

18 Five forces equal in magnitude each equals 10 newton act on one of vertices of a regular hexagon in direction of the other vertices as shown in the opposite figure , then the resultant of this forces is ..... newton.



(a) 50 (b) 20

(c) $30\sqrt{3}$ (d) $\left(20 + 10\sqrt{3}\right)$

Model 10

Interactive test 10

Answer the following questions :

1 The point which lies on the circle : $x^2 + (y - 5)^2 = 20$ is .....

(a) (2 , 3) (b) (3 , – 2) (c) (2 , 5) (d) (4 , 3)

2 Two forces of magnitudes 3 , 4 newton their resultant is 7 newton , then the measure of the angle between them is .....

(a) zero. (b) 60° (c) 180° (d) 90°

3 If $\overrightarrow{F_1}$, $\overrightarrow{F_2}$ and $\overrightarrow{F_3}$ are three forces meeting at a point and they are in equilibrium , then the magnitude of the resultant of $\overrightarrow{F_1}$ and $\overrightarrow{F_2}$ = ...

(a) F_1 (b) $F_1 + F_2$ (c) F_3 (d) zero

4 Two forces of magnitudes 8 , F newton act , at a particle , if the measure of the included angle is 120° , and their resultant $F\sqrt{3}$ newton , then F = ... newton.

(a) 4 (b) $4\sqrt{2}$ (c) $4\sqrt{3}$ (d) 8

5 The length of the drawer of a right circular cone is 17 cm. and its height = 15 cm. , then its total surface area = ... cm^2

(a) 200 π (b) 136 π (c) 320 π (d) 400 π

6 The length of the base side of a regular quadrilateral pyramid is 20 cm. and its height is $10\sqrt{3}$ cm. , **then find :**

(1) The lateral surface area. (2) The volume of the pyramid.

7 If O is the origin of perpendicular Cartisian coordinate plane and $\vec{F}$ = (8 kg.wt. , 135°) is a force acts at the point O , then the component of $\vec{F}$ in direction of y-axis equals .....

(a) $-4\sqrt{2}$ (b) $4\sqrt{2}$ (c) $4\sqrt{3}$ (d) 4

8 ABCDEF is a regular hexagon , forces of magnitudes 8 , $6\sqrt{3}$, 5 , $4\sqrt{3}$ newton in directions $\overrightarrow{AB}$, $\overrightarrow{AC}$, $\overrightarrow{AD}$, $\overrightarrow{AE}$ respectively. Find magnitude and direction of the resultant of this forces.

9 A body of weight 32 newton is suspended at the end of a string with length 10 cm. and the other end of the string is fixed at a point on a vertical wall and the body is pulled by horizontal force to make the body in equilibrium when it distant 6 cm. from the wall. Find magnitude of this force and the tension of the string.

10 A body of weight 18 newton is placed on a smooth plane inclines to the horizontal by angle of measure 30° and kept in equilibrium by a horizontal force of magnitude F newton. Find the magnitude of this force and the reaction of the plane on the body.

11 The equation of the circle which its centre $(-4 , 3)$ and passes through the origin point is .....

(a) $(x+4)^2 + (y-3)^2 = 5$

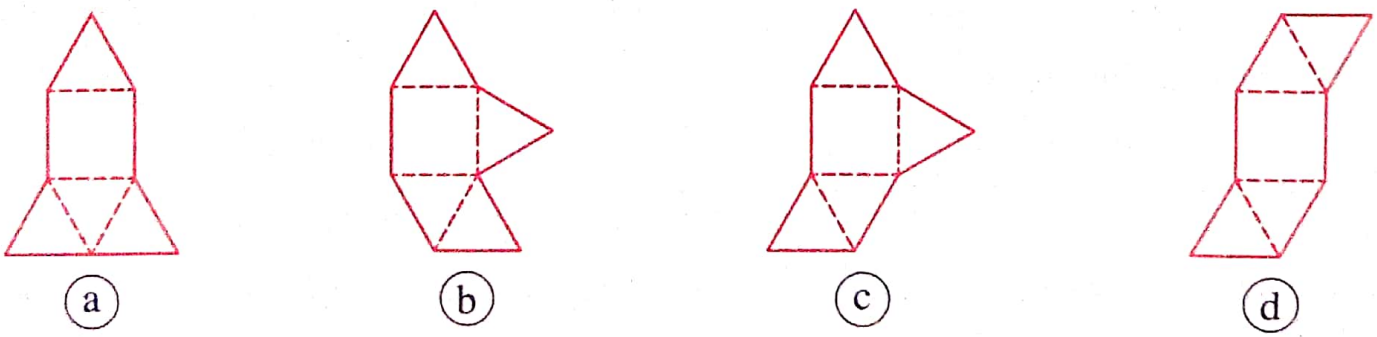
(b) $(x-4)^2 + (y+3)^2 = 25$

(c) $(x+4)^2 + (y-3)^2 = 625$

(d) $(x+4)^2 + (y-3)^2 = 25$

12 A cylindrical shaped vessel contains water , a metallic body in the form of a right cone , its height is 12 cm. and the length of its base radius is 2 cm. is completely immersed in it raising the surface of the water in the vessel with 1 cm. Find the length of base diameter of the vessel.

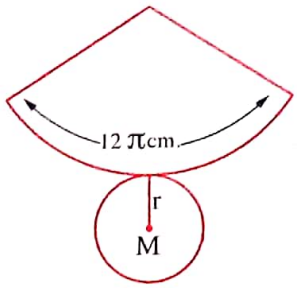
13 Which of the following nets does not make a regular quadrilateral pyramid when it is folded ?



(a) (b) (c) (d)

14 Five coplanar forces meeting at a point their magnitudes are 12 , 9 , $5\sqrt{2}$, $7\sqrt{2}$ and 7 kg.wt. act due east , north , western north , western south and south respectively , prove that the system is in equilibrium.

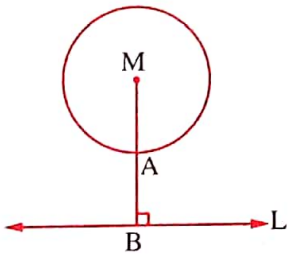
15 The opposite figure describes a solid its volume = 96 π cm^3 , its total surface area = ... cm^2



(a) 96 π (b) 48 π
(c) 32 π (d) 16 π

16 **In the opposite figure :**

If the equation of the circle is : $x^2 + y^2 - 6x + 4y - 12 = 0$, $\overline{MB} \perp L$ where $L : 3x - 4y + 23 = 0$, $\overline{MB}$ intersects the circle at A , then length of $\overline{AB}$ = ... length unit.



(a) 3 (b) 5 (c) 8 (d) 12

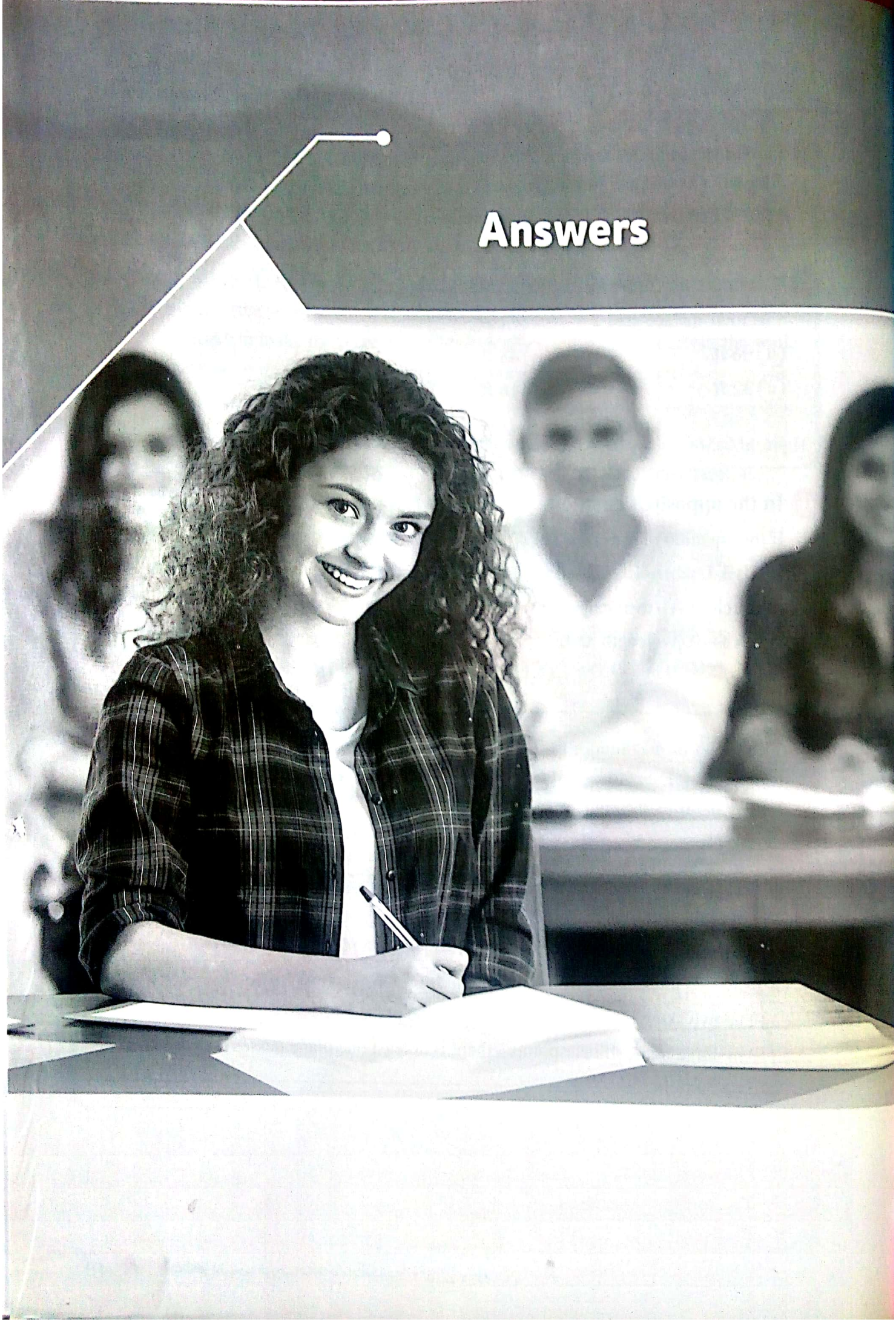
17 Two forces of magnitudes F , $F\sqrt{3}$ newton act at a particle , the magnitude of their resultant R = F newton , and θ_1 is the measure of the angle between 1st force and the resulat and θ_2 is the angle between the 2nd force and the resultant , then .....

(a) $\theta_1 = \theta_2$ (b) $\theta_1 = \frac{1}{2}\theta_2$ (c) $\theta_1 = 3\theta_2$ (d) $\theta_1 = 4\theta_2$

18 Which of the following statements is not true ?

(a) Any two different parallel straight line identify a plane ?
(b) Any two intersecting different straight lines have a common point.
(c) The two skew lines aren't contained in one plane.
(d) Any three non collinear points , there is at least one plane passes through them.

Answers



Guide answers of accumulative tests on Statics

Accumulative quiz 1

1 (1) d (2) b (3) a (4) c

2

F = 8 newton , the measure of the inclination angle of the resultant on $\overrightarrow{F}$ = 30°

3

F = 8 newton

Accumulative quiz 2

1 (1) a (2) c (3) c (4) d

2

$F = 4\sqrt{2}$ newton , R = 4 newton.

3

50 , $50\sqrt{3}$ newton.

Accumulative quiz 3

1 (1) b (2) c (3) c (4) c

2

$R \simeq 15.16$ kg.wt. , $\theta \simeq 99° 30\grave{}$

3

22 , 10 kg.wt. , $R = 2\sqrt{201}$ kg.wt.

Accumulative quiz 4

1 (1) c (2) d (3) b (4) a

2

$100\sqrt{3}$ gm.wt. , $100\sqrt{3}$ gm.wt.

3

a = – 1 , b = 1

Accumulative quiz 5

1

135° , prove by yourself.

2

$R = 4\sqrt{2}$ newton , in direction of $\overrightarrow{AC}$

3

$T = \frac{20\sqrt{3}}{3}$ gm.wt , $r = \frac{10\sqrt{3}}{3}$ gm.wt.

4

$9\sqrt{7}$ newton , $\sqrt{7}$ newton.

Guide answers of accumulative tests on Geometry and Measurement

Accumulative quiz 1

1

(1) d (2) a (3) d (4) a (5) d

2

(1) The two planes ABCD , $\grave{A}\ \grave{B}\ \grave{C}\ \grave{D}$
(there are other solutions)

(2) The two planes ABCD , $A\ B\ \grave{B}\ \grave{A}$
(there are other solutions)

(3) The two straight lines $\overleftrightarrow{AB}$, $\overleftrightarrow{\grave{B}\grave{C}}$
(there are other solutions)

(4) $\overleftrightarrow{AB}$, the plane $\grave{A}\ \grave{B}\ \grave{C}\ \grave{D}$
(there are other solutions)

(5) $\overleftrightarrow{AB}$

Accumulative quiz 2

1

(1) b (2) c (3) b (4) d

2

(1) Lateral area = 800 cm^2.

(2) The volume = $\frac{4000\sqrt{3}}{3}$ cm^3.

3

Total area = $576\sqrt{3}$ cm^2.

Accumulative quiz 3

1

(1) a (2) a (3) d (4) d

2

Lateral height = 15 cm. ,

lateral area = 540 cm^2.

3

14 cm.

Accumulative quiz 4

1

(1) a (2) c (3) a (4) d

2

$x^2 + y^2 + 4x - 10y - 5 = 0$

3

(1) Total area = 96π cm^2.

(2) Volume = 96π cm^3.

Answers of school book examination

1

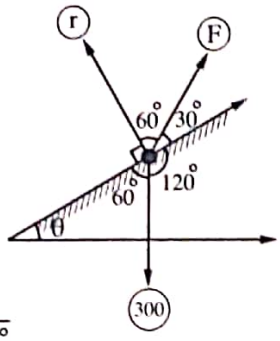
(1) (a) (2) (d) (3) (d) (4) (b)

2

(a) $5 + a - 14 = 10\sqrt{2}\cos 135° = -10$ $\therefore a = -1$

, $3 + 6 + b = 10\sqrt{2}\sin 135° = 10$ $\therefore b = 1$

(b) Let the angle between the inclined plane and the horizontal be θ



$\therefore \tan\theta = \frac{1}{\sqrt{3}}$

$\therefore \theta = 30°$

$\therefore \frac{F}{\sin 150°} = \frac{r}{\sin 150°} = \frac{300}{\sin 60°}$

$\therefore \frac{F}{\frac{1}{2}} = \frac{r}{\frac{1}{2}} = \frac{300}{\frac{\sqrt{3}}{2}}$

$\therefore F = r = \frac{300 \times \frac{1}{2}}{\frac{\sqrt{3}}{2}} = 100\sqrt{3}$ gm.wt.

3

(a) $(x-2)^2 + (y+1)^2 = 3^2$

$\therefore x^2 + y^2 - 4x + 2y - 4 = 0$

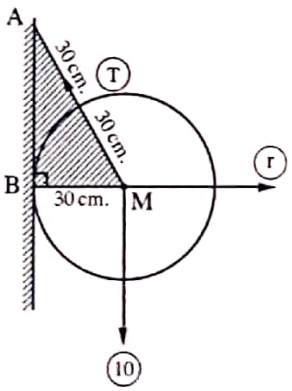
(b) Δ MAB is the triangle of forces

where AM = 60 cm.

, MB = 30 cm.

$\therefore AB = \sqrt{(60)^2 - (30)^2}$

$= 30\sqrt{3}$



Applying the triangle of forces rule :

$\frac{r}{30} = \frac{T}{60} = \frac{10}{30\sqrt{3}}$

$\therefore r = \frac{10\sqrt{3}}{3}$ gm.wt. , $T = \frac{20\sqrt{3}}{3}$ gm.wt.

4

(a) Volume of the wax = volume of cube

$= (30)^3 = 27000$ cm^3.

, $\because$ 8% of wax had been lost during the melting and transferring

$\therefore$ The volume of the cone = 92% × 27000

$= 24840$ cm^3.

$\because$ volume of the cone $= \frac{1}{3}\pi r^2 h$

$\therefore \frac{1}{3} \times \pi \times r^2 \times 45 = 24840$

$\therefore r \approx 22.959$ cm.

(b) $\because (AB)^2 = (BC)^2 + (AC)^2$

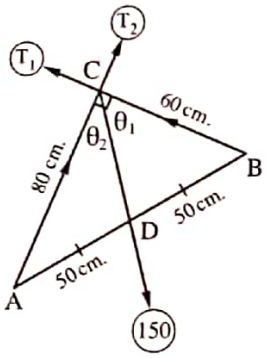
$\therefore m(\angle ACB) = 90°$, $\therefore CD = \frac{1}{2}AB = 50$ cm.

$\therefore CD = DB$, $\therefore m(\angle B) = \theta_1$

, $\because CD = AD$, $\therefore m(\angle A) = \theta_2$

$\frac{T_1}{\sin(90° + \theta_1)} = \frac{T_2}{\sin(90° + \theta_2)}$

$= \frac{150}{\sin 90°}$



$\therefore \frac{T_1}{\cos\theta_1} = \frac{T_2}{\cos\theta_2} = \frac{150}{1}$

$\therefore \frac{T_1}{\frac{6}{10}} = \frac{T_2}{\frac{8}{10}} = 150$

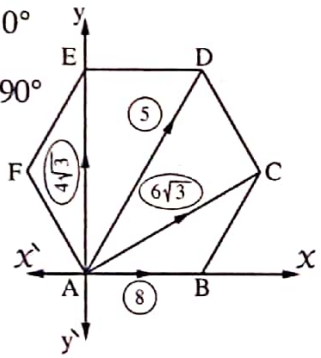
$\therefore T_1 = 90$ gm.wt. , $T_2 = 120$ gm.wt.

5

(a) $X = 8\cos 0° + 6\sqrt{3}\cos 30° + 5\cos 60° + 4\sqrt{3}\cos 90°$

$= 8 \times 1 + 6\sqrt{3} \times \frac{\sqrt{3}}{2} + 5 \times \frac{1}{2} + 4\sqrt{3} \times 0$

$= \frac{39}{2}$



, $Y = 8\sin 0° + 6\sqrt{3}\sin 30° + 5\sin 60° + 4\sqrt{3}\sin 90°$

$= 8 \times 0 + 6\sqrt{3} \times \frac{1}{2} + 5 \times \frac{\sqrt{3}}{2} + 4\sqrt{3} \times 1 = \frac{19\sqrt{3}}{2}$

$\therefore \vec{R} = \frac{39}{2}\hat{i} + \frac{19\sqrt{3}}{2}\hat{j}$

$\therefore R = \sqrt{\left(\frac{39}{2}\right)^2 + \left(\frac{19\sqrt{3}}{2}\right)^2} = \sqrt{651}$ newton

, $\tan\theta = \frac{19}{39}\sqrt{3}$ $\therefore \theta \simeq 40° 9'$

(b) $\because$ The set of forces are in equilibrium

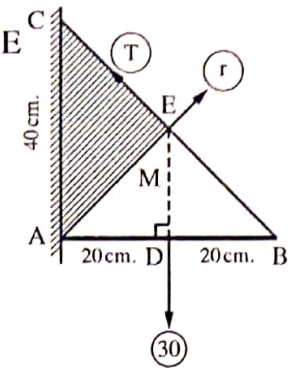
$\therefore \vec{r}$ passes through the point E

, $\because$ D is the midpoint of $\overline{AB}$, $\overline{DE} \parallel \overline{AC}$

$\therefore$ E is the midpoint of $\overline{CB}$

, $\because BC = \sqrt{(40)^2 + (40)^2}$

$= 40\sqrt{2}$



$\therefore CE = 20\sqrt{2}$ and $AE = 20\sqrt{2}$

$\therefore \Delta AEC$ is triangle of forces

$\therefore \frac{r}{20\sqrt{2}} = \frac{T}{20\sqrt{2}} = \frac{30}{40}$

$\therefore r = T = 15\sqrt{2}$ newton.

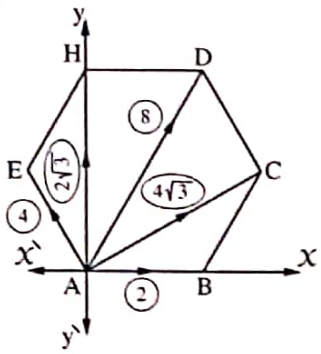
Answers of models

Model 1

1 (b) **2** (c) **3** (a) **4** (c) **5** (d)

6

Let $\overrightarrow{AB}$ in the direction of $\overrightarrow{OX}$



$\therefore X = 2\cos 0° + 4\sqrt{3}\cos 30° + 8\cos 60° + 2\sqrt{3}\cos 90° + 4\cos 120°$

$= 2\times 1 + 4\sqrt{3}\times\frac{\sqrt{3}}{2} + 8\times\frac{1}{2} + 2\sqrt{3}\times 0 + 4\times\frac{-1}{2} = 10$

, $Y = 2\sin 0° + 4\sqrt{3}\sin 30° + 8\sin 60° + 2\sqrt{3}\sin 90° + 4\sin 120°$

$= 2\times 0 + 4\sqrt{3}\times\frac{1}{2} + 8\times\frac{\sqrt{3}}{2} + 2\sqrt{3}\times 1 + 4\times\frac{\sqrt{3}}{2}$

$= 10\sqrt{3}$

$\therefore \vec{R} = 10\vec{i} + 10\sqrt{3}\vec{j}$

$\therefore R = \sqrt{(10)^2 + (10\sqrt{3})^2} = 20$ kg.wt.

, $\tan\theta = \frac{10\sqrt{3}}{10} = \sqrt{3}$ $\therefore \theta = 60°$

$\therefore$ The magnitude of $\vec{R}$ = 20 kg.wt. and makes an angle of measure 60° with $\overrightarrow{OX}$

7 (b)

8

(1) The area of the base $= \pi r^2$

$\therefore 36\pi = \pi r^2$ $\therefore r = 6$ cm.

, the lateral area $= \pi r L = \pi\times 6\times 10 = 60\pi$ cm^2.

(2) The total area $= \pi r(L + r) = \pi\times 6(10 + 6)$

$= 96\pi$ cm^2.

, $h = \sqrt{(10)^2 - (6)^2} = 8$ cm.

(3) Volume $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi\times 6^2\times 8 = 96\pi$ cm^3.

9 (a) **10** (a)

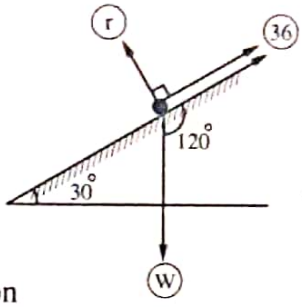
11

Applying lami's rule.

$\frac{36}{\sin 150°} = \frac{W}{\sin 90°} = \frac{r}{\sin 120°}$

$\therefore W = \frac{36\sin 90°}{\sin 150°} = 72$ newton

, $r = \frac{36\sin 120°}{\sin 150°} = 36\sqrt{3}$ newton



12 (d)

13

$\because x^2 + y^2 - 12x + 6y + 20 = 0$

$\therefore \ell = -6$, $k = 3$, $c = 20$

$\therefore$ The centre of the circle is $(6, -3)$

, $r = \sqrt{\ell^2 + k^2 - c} = \sqrt{36 + 9 - 20} = 5$ length units

$\therefore$ The centre of the required circle is $(8, -5)$ and its radius length = 5

$\therefore$ Its equation is $(x - 8)^2 + (y + 5)^2 = 25$

14 (c)

15

Suppose that :

$AB = 4\ell$ $\therefore CB = 2\ell$

$\therefore CE = \ell$ $\therefore AC = 2\sqrt{3}\ell$

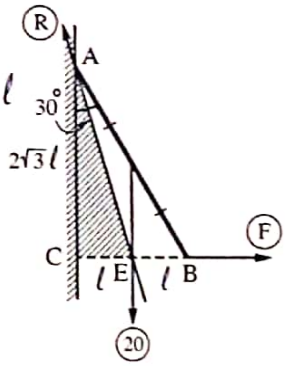
In ΔACE : $AE = \sqrt{13}\ell$

$\because \Delta ACE$ is the Δ of forces

$\frac{20}{2\sqrt{3}\ell} = \frac{F}{\ell} = \frac{R}{\sqrt{13}\ell}$

$\therefore F = \frac{10\sqrt{3}}{3}$ kg.wt.

$R = \frac{10\sqrt{39}}{3}$ kg.wt.



16 (b)

17

Volume of the wax = Volume of cube

$= (20)^3 = 8000$ cm^3.

, $\because$ 12% of wax had been lost during the melting and reforming

$\therefore$ The volume of the cone = 88% $\times$ 8000

$= \frac{88}{100}\times 8000$

$= 7040$ cm^3.

, ∵ volume of the cone = $\frac{1}{3}\pi r^2 h$

$\therefore \frac{1}{3} \times \frac{22}{7} \times r^2 \times 21 = 7040$

$\therefore r^2 = 320 \qquad \therefore r = 8\sqrt{5}$ cm.

18 (a) **19** (d) **20** (b)

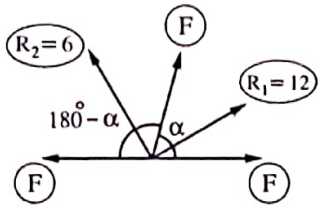
Model 2

1 (a) **2** (b) **3** (a) **4** (b) **5** (d)

6

$R_1 = 2F\cos\frac{\alpha}{2} = 12$

$\therefore F\cos\frac{\alpha}{2} = 6 \quad (1)$



, $R_2 = 2F\cos\left(\frac{180° - \alpha}{2}\right) = 6$

$\therefore F\sin\frac{\alpha}{2} = 3 \quad (2)$

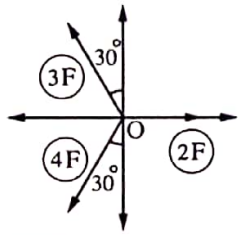
squaring the two equations and adding them

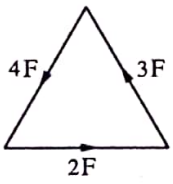
$\therefore F^2\cos^2\frac{\alpha}{2} + F^2\sin^2\frac{\alpha}{2} = 6^2 + 3^2$

$\therefore F^2\left(\cos^2\frac{\alpha}{2} + \sin^2\frac{\alpha}{2}\right) = 45$

$\therefore F = \sqrt{45} = 3\sqrt{5}$ kg.wt.

7





Suppose $\overrightarrow{OX}$ in the direction of the 1st force.

$X = 2F\cos 0° + 3F\cos 120° + 4F\cos 240°$

$= 2F \times 1 + 3F \times -\frac{1}{2} + 4F \times -\frac{1}{2} = -\frac{3}{2}F$

, $Y = 2F\sin 0° + 3F\sin 120° + 4F\sin 240°$

$= 2F \times 0 + 3F \times \frac{\sqrt{3}}{2} + 4F \times -\frac{\sqrt{3}}{2} = \frac{-\sqrt{3}}{2}F$

$\therefore \vec{R} = -\frac{3}{2}F\vec{i} - \frac{\sqrt{3}}{2}F\vec{j}$

$\therefore R = \sqrt{\left(-\frac{3}{2}F\right)^2 + \left(-\frac{\sqrt{3}}{2}F\right)^2} = \sqrt{3}F$ newton

$\tan\theta = \frac{-\sqrt{3}}{2} \times \frac{-2}{3} = \frac{\sqrt{3}}{3}$

, ∵ $X < 0$, $Y < 0 \qquad \therefore \theta = 210°$

∴ The magnitude of the resultant is $\sqrt{3}F$ gm.wt. and its direction makes an angle of measure 210° with $\overrightarrow{OX}$

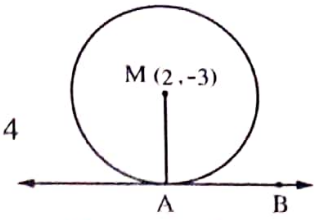
8 (a)

9

∵ $\overline{MA} \perp \overline{AB}$

$\therefore MA = \frac{|3 \times 2 - 4 \times -3 + 2|}{\sqrt{3^2 + 4^2}} = 4$

$\therefore r = 4$



∴ Equation of the circle is : $(x-2)^2 + (y+3)^2 = 16$

10 (c) **11** (b)

12

(**1**) In Δ MNE :

$MN = \sqrt{(25)^2 - (20)^2} = 15$ cm.

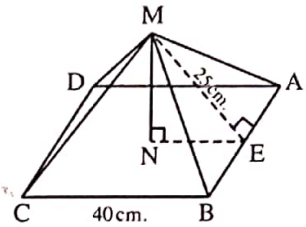
i.e. height = 15 cm.

(**2**) The lateral area

$= \frac{1}{2}$ × base perimeter × slant height

$= \frac{1}{2} \times (4 \times 40) \times 25$

$= 2000$ cm^2.



(**3**) The total area = $2000 + (40)^2 = 3600$ cm^2.

(**4**) The volume = $\frac{1}{3} \times (40)^2 \times 15 = 8000$ cm^3.

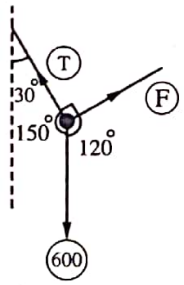
13 (d)

14

From the figure and using lami's rule

$\therefore \frac{600}{\sin 90°} = \frac{F}{\sin 150°} = \frac{T}{\sin 120°}$

$\therefore \frac{600}{1} = \frac{F}{\frac{1}{2}} = \frac{T}{\frac{\sqrt{3}}{2}}$



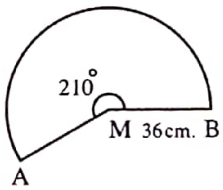
$\therefore F = 300$ dyne $\qquad T = 300\sqrt{3}$ dyne

15 (c)

16

Length of the arc $\overset{\frown}{AB}$

$= MB \cdot \theta^r = 36 \times \frac{210}{180}\pi = 42\pi$ cm.



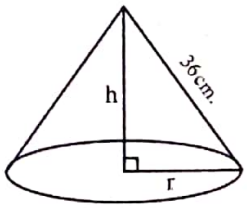
Circumference of the base of the cone = 42π

$\therefore 2\pi r = 42\pi$

$\therefore r = 21$

$\therefore h = \sqrt{36^2 - 21^2} = 3\sqrt{95}$ cm.

$\simeq 29.2$ cm.



17 (a) **18** (a) **19** (b)

Model 3

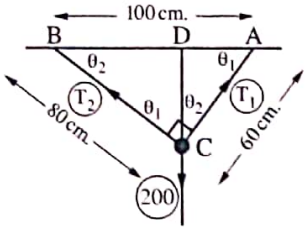
1 (c) **2** (a) **3** (c) **4** (b)

5

$\because (60)^2 + (80)^2 = (100)^2$

$\therefore \Delta$ ACB is right-angled at C

From lami's rule



$\therefore \frac{200}{\sin 90°} = \frac{T_1}{\sin \theta_1} = \frac{T_2}{\sin \theta_2}$

$\because \sin \theta_1 = \frac{BC}{AB} = \frac{80}{100} = \frac{4}{5}$

, $\sin \theta_2 = \frac{AC}{AB} = \frac{60}{100} = \frac{3}{5}$

$\therefore \frac{200}{1} = \frac{T_1}{\frac{4}{5}} = \frac{T_2}{\frac{3}{5}}$

$\therefore T_1 = 200 \times \frac{4}{5} = 160$ gm.wt.

, $T_2 = 200 \times \frac{3}{5} = 120$ gm.wt.

6

From the given

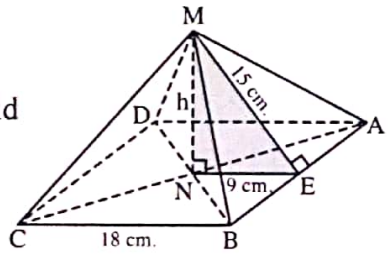
$h = \sqrt{15^2 - 9^2} = 12$ cm.

$\therefore$ Volume of the pyramid

$= \frac{1}{3}$ area of base $\times$ h

$= \frac{1}{3} \times (18)^2 \times 12$

$= 1296$ cm^3.



7 (c)

8

$R = \sqrt{F_1^2 + F_2^2 + 2 F_1 F_2 \cos \propto}$

$= \sqrt{6^2 + 12^2 + 2 \times 6 \times 12 \times \cos 120°}$

$= 6\sqrt{3}$ newton.

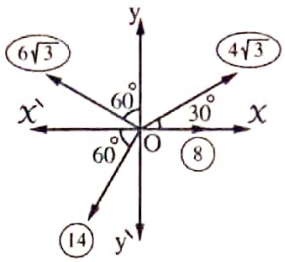
$\because \tan \theta = \frac{F_2 \sin \propto}{F_1 + F_2 \cos \propto} = \frac{12 \sin 120}{6 + 12 \cos 120} = \frac{6\sqrt{3}}{0}$

$\therefore \theta = 90°$ (with first force)

9 (b)

10

Suppose $\overrightarrow{OX}$ is the direction of the first force



$X = 8 \cos 0° + 4\sqrt{3} \cos 30°$

$+ 6\sqrt{3} \cos 150° + 14 \cos 240°$

$= 8 \times 1 + 4\sqrt{3} \times \frac{\sqrt{3}}{2} + 6\sqrt{3} \times \left(-\frac{\sqrt{3}}{2}\right) + 14 \times \left(-\frac{1}{2}\right)$

$= 8 + 6 - 9 - 7 = -2$

, $Y = 8 \sin 0° + 4\sqrt{3} \sin 30°$

$+ 6\sqrt{3} \sin 150° + 14 \sin 240°$

$= 8 \times 0 + 4\sqrt{3} \times \frac{1}{2} + 6\sqrt{3} \times \frac{1}{2} + 14 \times \left(-\frac{\sqrt{3}}{2}\right)$

$= -2\sqrt{3}$

$\therefore \vec{R} = -2 \vec{i} - 2\sqrt{3} \vec{j}$

$\therefore R = \sqrt{(-2)^2 + \left(-2\sqrt{3}\right)^2} = 4$ newton

, $\tan \theta = \frac{-2\sqrt{3}}{-2} = \sqrt{3}$

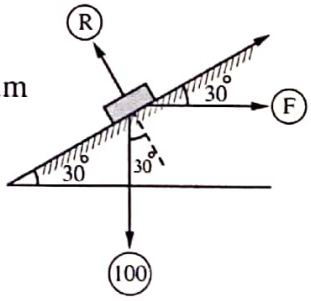
$\because$ X and Y are negative $\therefore \theta = 240°$

$\therefore$ The magnitude of the resultant is 4 newton and makes an angle of measure 240° with $\overrightarrow{OX}$

11 (a) **12** (b) **13** (c)

14

$\because$ The forces which acting at the body are in equilibrium



$\therefore \frac{100}{\sin 120} = \frac{R}{\sin 90} = \frac{F}{\sin 150}$

$\therefore F = \frac{100\sqrt{3}}{3}$ newton

, $R = \frac{200\sqrt{3}}{3}$ newton

15 (b)

16

$\because$ Centre of 1st circle C_1 (1 , -3)

, the 2nd circle is $x^2 + y^2 - 2x + 6y + \frac{15}{4} = 0$

$\therefore$ Centre of 2nd circle $C_2 = (1 , -3)$

$\therefore$ They have same centre

$\therefore$ They are concentric circles.

$r_1 = \sqrt{(1)^2 + (-3)^2 - 1} = 3$ length unit.

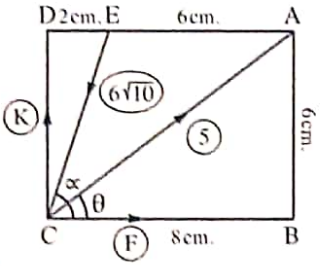
, $r_2 = \sqrt{(1)^2 + (-3)^2 - \frac{15}{4}} = 2.5$ length unit.

17 (b) **18** (b) **19** (d)

Model 4

1 (d) **2** (b) **3** (c)

4



From the figure :

$CE = 2\sqrt{10}$ cm.

∵ The forces are in equilibrium

∴ $x = 0$, $y = 0$

∴ $F\cos 0° + 5\cos\theta - 6\sqrt{10}\cos\alpha + k\cos 90° = 0$

∴ $F + 5 \times \frac{8}{10} - 6\sqrt{10} \times \frac{2}{2\sqrt{10}} + k \times 0 = 0$

∴ $F = 2$ newton.

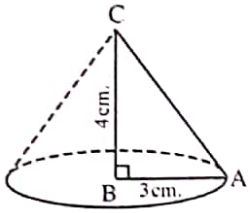
, $F\sin 0° + 5\sin\theta - 6\sqrt{10}\sin\alpha + k\sin 90° = 0$

∴ $0 + 5 \times \frac{6}{10} - 6\sqrt{10} \times \frac{6}{2\sqrt{10}} + k \times 1 = 0$

∴ $k = 15$ newton.

5 (d)

6



The volume $= \frac{1}{3}$ base area $\times$ h

$= \frac{1}{3} \times \pi (3)^2 \times 4$

$= 12\pi$ cm^3.

7

Radius of base = 6 units and its height = 8 units

(1) Volume of the cone

$= \frac{1}{3} \times \pi (6)^2 \times 8 = 96\pi$ cubic units

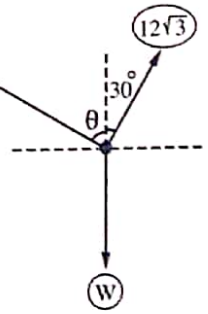
(2) Length of drawer $= \sqrt{6^2 + 8^2} = 10$ units

Total surface area $= \pi r (\ell + r)$

$= \pi \times 6 (10 + 6) = 96\pi$ square units

8 (d) **9** (b)

10



From lami's rule

$\frac{W}{\sin(\theta + 30°)} = \frac{12}{\sin 150} = \frac{12\sqrt{3}}{\sin(180 - \theta)}$

∴ $\sin\theta = \frac{12\sqrt{3} \times \sin 150}{12} = \frac{\sqrt{3}}{2}$

∴ $\theta = 60°$

∴ $W = \frac{12\sin(60 + 30)}{\sin 150} = 24$ newton.

11 (a)

12

From the properties of the solid,

$h = \sqrt{15^2 - 9^2} = 12$ cm.

∴ Volume of the pyramid

$= \frac{1}{3}$ area of the base $\times$ h

$= \frac{1}{3} \times (18)^2 \times 12 = 1296$ cm.^{3}

13

Let the centre is $(x , 0) \in x$-axis

∴ The centre is equidistant from $(1 , 3)$, $(2 , -4)$

∴ $\sqrt{(x-1)^2 + (0-3)^2} = \sqrt{(x-2)^2 + (0-(-4))^2}$

∴ $\sqrt{x^2 - 2x + 1 + 9} = \sqrt{x^2 - 4x + 4 + 16}$

∴ $x^2 - 2x + 10 = x^2 - 4x + 20$

∴ $2x = 10$ ∴ $x = 5$

∴ The centre is $(5 , 0)$ ∴ $r = \sqrt{(5-1)^2 + (0-3)^2} = 5$

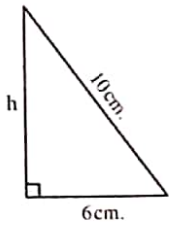
∴ The equation of the circle is $(x - 5)^2 + y^2 = 25$

14 (a) **15** (d) **16** (a)
17 (c) **18** (c) **19** (b)

Model 5

1 (d) **2** (a) **3** (d)
4 (b) **5** (c)

6



∵ The total surface area $= \pi r (L + r)$

$96\pi = \pi \times r \times (10 + r)$

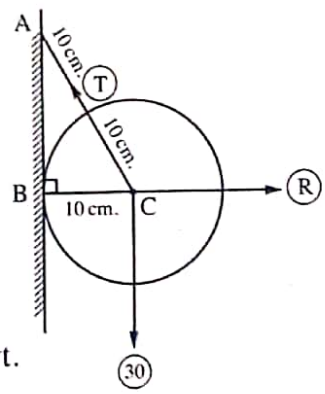
∴ $r^2 + 10r - 96 = 0$

∴ $r = -16$ (refused) or $r = 6$ cm.

∴ $h = \sqrt{10^2 - 6^2} = 8$ cm.

∴ Volume of the cone $= \frac{1}{3}\pi (6)^2 \times 8 = 96\pi$ cm.^{3}

7



From the figure Δ ABC represents a triangle

forces , $AB = \sqrt{20^2 - 10^2}$

$= 10\sqrt{3}$

∴ $\frac{30}{10\sqrt{3}} = \frac{R}{10} = \frac{T}{20}$

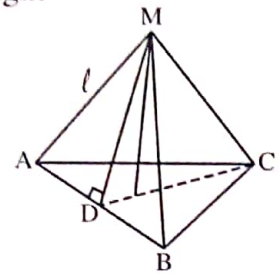
∴ $T = \frac{30 \times 20}{10\sqrt{3}} = 20\sqrt{3}$ gm.wt.

, $R = \frac{30 \times 10}{10\sqrt{3}} = 10\sqrt{3}$ gm.wt.

8

MAB is equilaterl triangle its height

$MD = \frac{\ell}{2}\sqrt{3}$ cm.



$\because$ MD is slant height of the pyramid

$\therefore$ Total area of the pyramid

= area of one face × 4

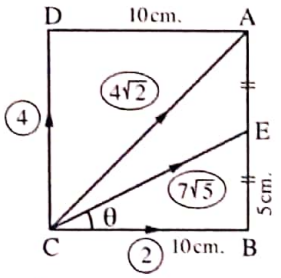
$= \frac{1}{2} \times \ell \times \frac{\sqrt{3}}{2}\ell \times 4 = \sqrt{3}\,\ell^2$ cm.^{2}

---

9 (c)

10

Consider $\overleftrightarrow{CB}$, $\overleftrightarrow{CD}$



axes $\overrightarrow{OX}$, $\overrightarrow{Oy}$

$\therefore X = 2\cos 0° + 7\sqrt{5}\cos\theta°$

$+ 4\sqrt{2}\cos 45° + 4\cos 90°$

$= 2 + 7\sqrt{5} \times \frac{10}{5\sqrt{5}} + 4\sqrt{2} \times \frac{1}{\sqrt{2}} + 0$

$\therefore X = 20$ newton

, $Y = 2\sin 0° + 7\sqrt{5}\sin\theta + 4\sqrt{2}\sin 45° + 4\sin 90°$

$= 0 + 7\sqrt{5} \times \frac{5}{5\sqrt{5}} + 4\sqrt{2} \times \frac{1}{\sqrt{2}} + 4$

$\therefore Y = 15$ newton

$\therefore R = \sqrt{x^2 + y^2} = \sqrt{20^2 + 15^2} = 25$ newton

$\tan\theta = \frac{Y}{X} = \frac{15}{20} = \frac{3}{4}$

$\therefore \theta = 36°\ 52\hat{}\ 12\hat{}$ with 1st force.

---

11 (b)

12

Centre of the circle is midpoint of $\overline{AB}$

$\therefore M = \left(\frac{2+(-4)}{2}, \frac{3+9}{2}\right) = (-1, 6)$

and its diameter length $= \sqrt{(2-(-4))^2 + (3-9)^2} = 6\sqrt{2}$

$\therefore (x+1)^2 + (y-6)^2 = \left(3\sqrt{2}\right)^2$

$\therefore x^2 + 2x + 1 + y^2 - 12y + 36 = 18$

$\therefore$ The general form of the equation of the circle

$x^2 + y^2 + 2x + 19y + 19 = 0$

13

$\because F_1 + F_2 = 25$ newton (1)

$\therefore F_1 - F_2 = 13$ newton (2)

by adding the two equations (1) , (2)

$2F_1 = 38$ $\therefore F_1 = 19$ newton.

From (1) : $19 + F_2 = 25$ $\therefore F_2 = 6$ newton.

---

14 (b) **15** (c) **16** (d) **17** (d) **18** (d)

Model 6

1 (c) **2** (d) **3** (d) **4** (b) **5** (c)

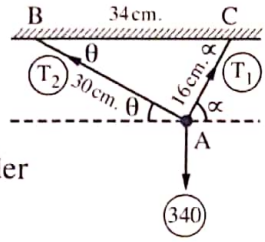
6

From the properties of the shape

$\because (34)^2 = (30)^2 + (16)^2$

$\therefore \overline{AC} \perp \overline{BA}$

$\because$ The body is in equilibrium under action of three forces.



$\therefore \frac{340}{\sin 90°} = \frac{T_1}{\sin(90° + \theta)} = \frac{T_2}{\sin(90° + \alpha)}$

$\therefore T_1 = \frac{340 \times \cos\theta}{\sin 90°} = \frac{340 \times \frac{30}{34}}{1} = 300$ gm.wt.

, $T_2 = \frac{340 \times \cos\alpha}{\sin 90°} = \frac{340 \times \frac{16}{34}}{1} = 160$ gm.wt.

---

7 (a)

8

$\because (AB)^2 = (BC)^2 + (AC)^2$

$\therefore m(\angle ACB) = 90°$

, $\therefore CD = \frac{1}{2}AB = 50$ cm.

$\therefore CD = DB$, $\therefore m(\angle B) = \theta_1$

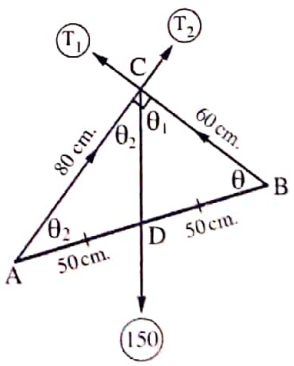
, $\because CD = AD$, $\therefore m(\angle A) = \theta_2$

$\frac{T_1}{\sin(90° + \theta_1)} = \frac{T_2}{\sin(90° + \theta_2)}$

$= \frac{150}{\sin 90°}$

$\therefore \frac{T_1}{\cos\theta_1} = \frac{T_2}{\cos\theta_2} = \frac{150}{1}$

$\therefore \frac{T_1}{\frac{6}{10}} = \frac{T_2}{\frac{8}{10}} = 150$



$\therefore T_1 = 90$ gm.wt. , $T_2 = 120$ gm.wt.

---

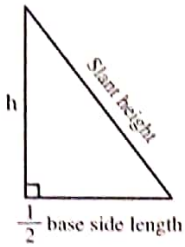
9 (d)

10

∵ The volume of the pyramid = 1296

∴ $\frac{1}{3} \times (18)^2 \times h = 1296$

∴ h = 12 cm.



∵ Slant height = $\sqrt{h^2 + \left(\frac{1}{2}\text{side}\right)^2}$

$= \sqrt{12^2 + \left(\frac{18}{2}\right)^2} = 15$ cm.

∴ Lateral surfac area = $\frac{1}{2}$ perimeter of the base × S.h.

$= \frac{1}{2} \times (4 \times 18) \times 15 = 540$ cm.^{2}

---

11 (a)

12

∵ The circumference of the base = 6 π

∵ 2 π r = 6 π ∴ r = 3 cm.

∵ The volume of the cone = 27 π

∴ $\frac{1}{3}\pi (3)^2 \times h = 27\pi$ ∴ h = 9 cm.

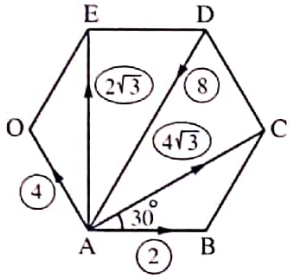
---

13 (c)

14

Consider the direction

$\overrightarrow{OX}$ is $\overrightarrow{AB}$



∴ X = 2 cos 0 + $4\sqrt{3}$ cos 30°

− 8 cos 60° + $2\sqrt{3}$ cos 90°

+ 4 cos 120°

= 2 + 6 − 4 + 0 − 2 = 2 kg.wt.

, Y = 2 sin 0° + $4\sqrt{3}$ sin 30° − 8 sin 60° + $2\sqrt{3}$ sin 90°

+ 4 sin 120°

= 0 + $2\sqrt{3} - 4\sqrt{3} + 2\sqrt{3} + 2\sqrt{3} = 2\sqrt{3}$ kg.wt.

∴ R = $\sqrt{(2)^2 + \left(2\sqrt{3}\right)^2} = 4$ kg.wt.

$\tan\theta = \frac{2\sqrt{3}}{2} = \sqrt{3}$ ∴ θ = 60°

∴ The resultant = 4 kg.wt. in direction $\overrightarrow{AD}$

---

15 (c)

16

The solid which generated by rotation around $\overline{BC}$ is two cones have common base and are congruent.

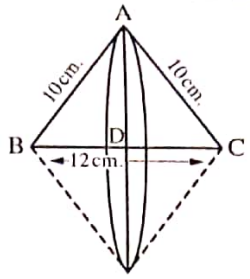
∵ AD = $\sqrt{10^2 - 6^2} = 8$ cm.

∴ The volume of the result solid

$= 2\left(\frac{1}{3}\pi r^2 h\right)$

$= 2 \times \frac{1}{3} \times \pi \times 8^2 \times 6$

$= 256\pi$ cm.^{2}



---

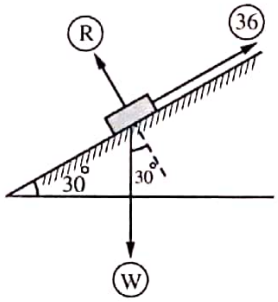
17 (a) **18** (c) **19** (c) **20** (c)

Model 7

1 (c) **2** (a) **3** (a) **4** (b)

5

The body in equilibrium under action of three forces meeting at a point.



∴ $\frac{W}{\sin 90°} = \frac{R}{\sin 120°} = \frac{36}{\sin 150°}$

∴ W = $\frac{36 \times \sin 90°}{\sin 150°} = 72$ newton.

, R = $\frac{36 \times \sin 120°}{\sin 150°} = 36\sqrt{3}$ newton.

---

6 (b) **7** (a)

8

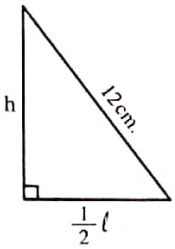
∵ Lateral surface area = 240

∴ $\frac{1}{2}$ (perimeter of the base) × slant height = 240

If ℓ is side length of the base.

∴ $\frac{1}{2} \times 4\ell \times 12 = 240$

∴ ℓ = 10 cm.



(1) ∵ Height of pyramid

$= \sqrt{12^2 - 5^2} = \sqrt{119}$ cm.

(2) Volume of pyramid = $\frac{1}{3}$ × area of base × h

$= \frac{1}{3} \times (10)^2 \times \sqrt{119} = \frac{100}{3}\sqrt{119} \simeq 363.6$ cm.^{3}

---

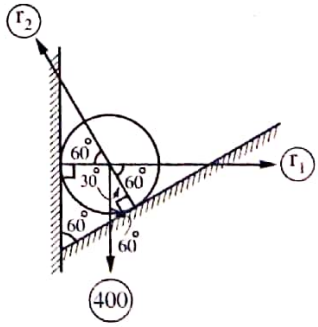
9 (c)

10

∵ The two planes are smooth

∴ r_1 and r_2 are perpendicular to the two planes and passes through the centre of the sphere.

Applying lami's rale



$\therefore \frac{r_1}{\sin 150°} = \frac{r_2}{\sin 90°} = \frac{400}{\sin 120°}$

$\therefore r_1 = \frac{400 \times \sin 150°}{\sin 120°} = \frac{400\sqrt{3}}{3}$ kg.wt.

$\therefore r_2 = \frac{400 \times \sin 90°}{\sin 120} = \frac{800\sqrt{3}}{3}$ kg.wt.

---

11 (d) **12** (b)

13

$\because \Delta$ AHB is right-angled at B

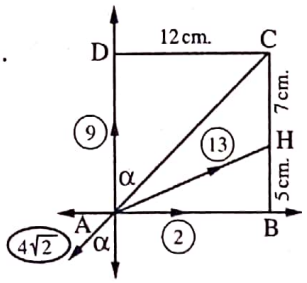
$\therefore AH = \sqrt{(5)^2 + (12)^2} = 13$ cm.

$\therefore \sin(\angle BAH) = \frac{5}{13}$

, $\cos(\angle BAH) = \frac{12}{13}$

$\because \overline{AC}$ is a diagonal of the square ABCD

$\therefore \alpha = 45°$



$\therefore X = 2\cos 0° + 13\cos(\angle BAH) + 9\cos 90° + 4\sqrt{2}\cos 225°$

$= 2 \times 1 + 13 \times \frac{12}{13} + 9 \times 0 + 4\sqrt{2} \times \frac{-1}{\sqrt{2}} = 10$

, $Y = 2\sin 0° + 13\sin(\angle BAH) + 9\sin 90° + 4\sqrt{2}\sin 225°$

$= 2 \times 0 + 13 \times \frac{5}{13} + 9 \times 1 + 4\sqrt{2} \times \frac{-1}{\sqrt{2}} = 10$

$\therefore \vec{R} = 10\vec{i} + 10\vec{j}$

$\therefore R = \sqrt{(10)^2 + (10)^2} = 10\sqrt{2}$ gm.wt.

, $\tan\theta = \frac{10}{10} = 1$ $\because X > 0$, $Y > 0$ $\therefore \theta = 45°$

$\therefore \vec{R}$ acts due to $\overrightarrow{AC}$

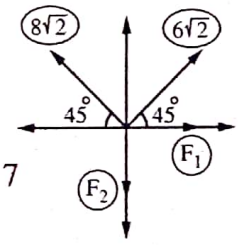
---

14 (c)

15

$\because X = 7$

$\therefore F_1\cos 0° + 6\sqrt{2}\cos 45° + 8\sqrt{2}\cos 135° + F_2\cos 270° = 7$



$\therefore F_1 + 6 - 8 + 0 = 7$

$\therefore F_1 = 9$ gm.wt.

, $Y = 0$

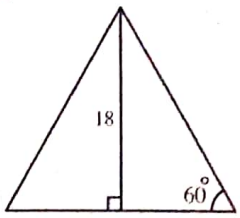
$\therefore F_1\sin 0° + 6\sqrt{2}\sin 45° + 8\sqrt{2}\sin 135° + F_2\sin 270° = 0$

$\therefore 0 + 6 + 8 + (-F_2) = 0$ $\therefore F_2 = 14$ gm.wt.

16

The resulting solid is triangular pyramid of regular faces and the lateral height = 18 cm.

in studying one of faces of the pyramid we get its side length ℓ where $\sin 60° = \frac{18}{\ell}$



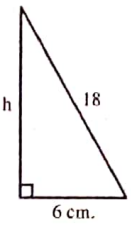
$\therefore \ell = \frac{18}{\sin 60°} = 12\sqrt{3}$ cm.

$\therefore$ Total area = 4 × area of one face

$= 4 \times \left(\frac{1}{2} \times 12\sqrt{3} \times 18\right)$

$= 432\sqrt{3}$ cm.^{2}

$\simeq 748.2$ cm.^{2}



$\therefore$ height of the pyramid $= \sqrt{18^2 - 6^2} = 12\sqrt{2}$ cm.

$\therefore$ The volume $= \frac{1}{3} \times \left(\frac{1}{2} \times 12\sqrt{3} \times 18\right) \times 12\sqrt{2}$

$= 432\sqrt{6} \simeq 1058$ cm.^{3}

---

17 (b) **18** (b)

Model 8

1 (c) **2** (d) **3** (d) **4** (b) **5** (d)

6

$\because$ Volume of the pyramid $= \frac{1}{3} \times$ base area $\times$ height

$\therefore 8\sqrt{3} = \frac{1}{3} \times$ base area $\times 4$

$\therefore$ Base area $= 6\sqrt{3}$ cm.^{2}

$\therefore \frac{6}{4} \times x^2 \times \cot\frac{\pi}{6} = 6\sqrt{3}$

$\therefore x^2 = 4$ $\therefore x = 2$

$\therefore$ Side length of the hexogon = 2 cm.

$\therefore$ Base perimeter = 6 × 2 = 12 cm.

---

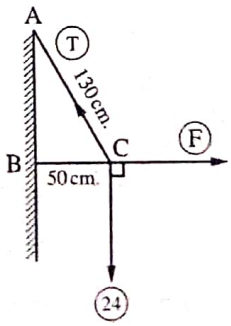
7 (c) **8** (a)

9

$\because AB = \sqrt{(130)^2 - (50)^2} = 120$ cm.

From the figure we get

Δ ABC is the triangle of forces



$\therefore \frac{T}{130} = \frac{F}{50} = \frac{24}{120}$

$\therefore F = \frac{24 \times 50}{120} = 10$ newton

, $T = \frac{24 \times 130}{120} = 26$ newton

---

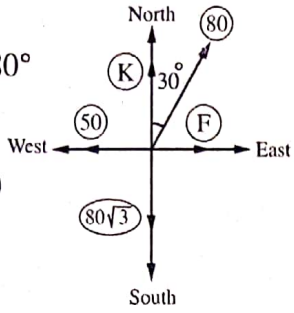
10 (d)

11

$\because X = F\cos 0° + 80\cos 60° + K\cos 90° + 50\cos 180° + 80\sqrt{3}\cos 270°$

$= F \times 1 + 80 \times \frac{1}{2} + K \times 0 + 50 \times -1 + 80\sqrt{3} \times 0$

$= F - 10$



$, Y = F\sin 0° + 80\sin 60° + K\sin 90° + 50\sin 180° + 80\sqrt{3}\sin 270°$

$= F \times 0 + 80 \times \frac{\sqrt{3}}{2} + K \times 1 + 50 \times 0 + 80\sqrt{3} \times -1 = K - 40\sqrt{3}$

$\therefore \vec{R} = (F - 10)\vec{i} + \left(K - 40\sqrt{3}\right)\vec{j}$ (1)

$\because R = 40$ newton due to 60° North of East

$\therefore \vec{R} = 40\cos 60°\,\vec{i} + 40\sin 60°\,\vec{j}$

$= 20\vec{i} + 20\sqrt{3}\,\vec{j}$ (2)

From (1) and (2) : $\therefore F - 10 = 20$

$\therefore F = 30$ newton

$, K - 40\sqrt{3} = 20\sqrt{3}$ $\therefore K = 60\sqrt{3}$ newton

---

12 (d)

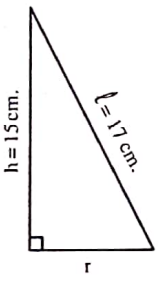
13

The radius length $= \sqrt{17^2 - 15^2} = 8$ cm.

$\therefore$ Total surface area

$= \pi r(\ell + r) = \pi \times 8 \times (17 + 8)$

$= 200\,\pi$ cm^2.



, volume of cone $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi (8)^2 \times 15 = 320$ cm^3.

---

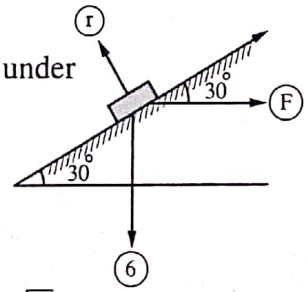
14 (b)

15

$\because$ The body is in equilibrium under acting of three forces

$\therefore$ Applying lami's rule

$\frac{6}{\sin 120°} = \frac{F}{\sin 150°} = \frac{r}{\sin 90°}$



$\therefore F = \frac{6 \times \sin 150°}{\sin 120°} = \frac{6 \times \frac{1}{2}}{\frac{\sqrt{3}}{2}} = 2\sqrt{3}$ kg.wt.

$, r = \frac{6 \times \sin 90°}{\sin 120°} = \frac{6 \times 1}{\frac{\sqrt{3}}{2}} = 4\sqrt{3}$ kg.wt.

16

From circle C_1 :

$r_1 = \sqrt{k}$, $P_1(-2, -11)$ is its centre

From circle C_2 :

$r_2 = \sqrt{16} = 4$, $P_2(3, 1)$ is its centre

The distance between the two centres

$P_1P_2 = \sqrt{(3+2)^2 + (1+11)^2} = 13$ length unit.

In case the two circles are toucting externally

$\therefore P_1P_2 = r_1 + r_2$ $\therefore 13 = \sqrt{k} + 4$

$\therefore \sqrt{k} = 13 - 4 = 9$ $\therefore k = 9^2 = 81$

In case the two circles are touching internally

$\therefore P_1P_2 = |r_1 - r_2|$ $\therefore 13 = |\sqrt{k} - 4|$

$\therefore 13 = \sqrt{k} - 4$ i.e. $\sqrt{k} = 13 + 4 = 17$

, then $k = 289$

or $-13 = \sqrt{k} - 4$ i.e. $\sqrt{k} = -13 + 4 = -9$ refused

$\therefore k = 81$ or 289

---

17 (d) **18** (d)

Model 9

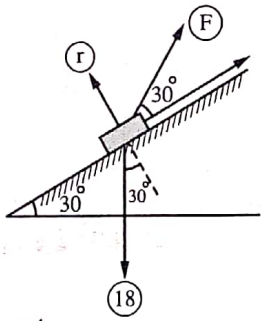
1 (c) **2** (c) **3** (b)

4

$\because$ The body is in equilibrium under acting of three coplanar forces meating at a point

$\therefore$ Applying lami's rule

$\frac{18}{\sin 60°} = \frac{F}{\sin 150°} = \frac{r}{\sin 150°}$



$\therefore F = r = \frac{18 \times \sin 150°}{\sin 60°} = 6\sqrt{3}$ kg.wt.

---

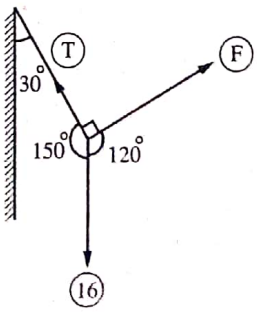
5 (a) **6** (c) **7** (d)

8

Applying lami's rule.

$\therefore \frac{F}{\sin 150°} = \frac{T}{\sin 120°} = \frac{16}{\sin 90°}$

$\therefore \frac{F}{\frac{1}{2}} = \frac{T}{\frac{\sqrt{3}}{2}} = 16$



$\therefore F = 8$ newton , $T = 8\sqrt{3}$ newton

9

$\because$ AC = AD = 4 metres

$\therefore$ m ($\angle$ ACD) = 45°

$\therefore$ CD = $4\sqrt{2}$ metres

From Δ MCN :

MN = 1 metre , m ($\angle$ NCM) = 45°

, m ($\angle$ NMC) = 90°

$\therefore$ NC = $\sqrt{2}$ metres

$\therefore$ DN = $4\sqrt{2} - \sqrt{2} = 3\sqrt{2}$ metres

From Δ AMN : AN = $\sqrt{10}$ metres (Pythagoras)

, $\because$ Since Δ AND is the triangle of forces

$\therefore \frac{r}{\sqrt{10}} = \frac{T}{3\sqrt{2}} = \frac{8}{4}$

$\therefore$ r = $2\sqrt{10}$ kg.wt. , T = $6\sqrt{2}$ kg.wt.

10

$r = \sqrt{2^2 + (2\sqrt{3})^2} = 4$ length units

$\therefore$ The centre of the circle M = (– 2 , 4)

$\therefore$ c = 4 + 16 – 16 = 4

$\therefore$ The equation of the circle is $x^2 + y^2 + 4x - 8y + 4 = 0$

---

11 (b)

12

The length of the drawer of the cone = 18 cm.

, $\because$ the circumference of circle of the cone base = the length of $\overset{\frown}{AB}$

$= r \times \theta^{rad} = 18 \times \frac{60° \times \pi}{180°} = 6\pi$

$\therefore 2\pi r = 6\pi$ $\quad\therefore r = 3$ cm.

$\therefore h = \sqrt{\ell^2 - r^2} = \sqrt{(18)^2 - 3^2} = 3\sqrt{35}$

$\therefore$ Volume of the cone = $\frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \pi \times (3)^2 \times 3\sqrt{35}$

$\simeq 167.3$ cm^3.

---

13 (c)

14

$X = 10\cos 0° + 20\cos 120° + 30\cos 240°$

$= 10 + 20 \times \frac{-1}{2} + 30 \times \frac{-1}{2} = -15$

$Y = 10\sin 0° + 20\sin 120° + 30\sin 240°$

$= 0 + 20 \times \frac{\sqrt{3}}{2} + 30 \times \frac{-\sqrt{3}}{2} = -5\sqrt{3}$

$\therefore \vec{R} = -15\vec{i} - 5\sqrt{3}\vec{j}$

$\therefore R = \sqrt{(-15)^2 + (-5\sqrt{3})^2} = 10\sqrt{3}$ newton.

, $\tan\theta = \frac{-5\sqrt{3}}{-15} = \frac{\sqrt{3}}{3}$ $\quad\therefore \theta = 210°$

$\therefore$ Line of action of the resultant in direction 30° south of west.

---

15 (b) **16** (c) **17** (d) **18** (d)

Model 10

1 (d) **2** (a) **3** (c) **4** (a) **5** (a)

6

The slant height = $\sqrt{(10\sqrt{3})^2 + (10)^2} = 20$ cm.

(1) Lateral surface area

$= \frac{1}{2}$ (perimeter of the base) × slant height

$= \frac{1}{2} \times (4 \times 20) \times 20$

$= 800$ cm^2.

(2) Volume = $\frac{1}{3}$ area of the base × h

$= \frac{1}{3} \times (20)^2 \times 10\sqrt{3} = \frac{4000\sqrt{3}}{3}$ cm^3.

---

7 (b)

8

$X = 8\cos 0° + 6\sqrt{3}\cos 30° + 5\cos 60° + 4\sqrt{3}\cos 90°$

$= 8 + 9 + \frac{5}{2} + 0 = \frac{39}{2}$

, $Y = 8\sin 0° + 6\sqrt{3}\sin 30° + 5\sin 60° + 4\sqrt{3}\sin 90°$

$= 0 + 2\sqrt{3} + \frac{5\sqrt{3}}{2} + 4\sqrt{3} = \frac{19}{2}\sqrt{3}$

$\therefore \vec{R} = \frac{39}{2}\vec{i} + \frac{19\sqrt{3}}{2}\vec{j}$ $\quad \therefore R = \sqrt{651}$ newton

$\because \tan\theta = \frac{\frac{19\sqrt{3}}{2}}{\frac{39}{2}} = \frac{19\sqrt{3}}{39}$

$\therefore \theta = 40°$ with $\overrightarrow{AB}$

9

$AB = \sqrt{10^2 - 6^2} = 8$

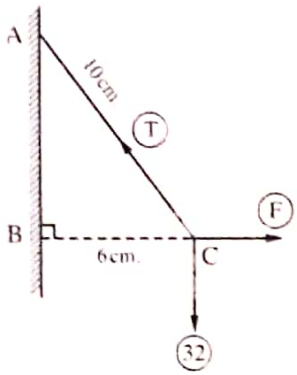
From the figure we get

Δ ABC is the triangle froces

$\therefore \frac{T}{10} = \frac{F}{6} = \frac{32}{8}$

$\therefore F = \frac{32 \times 6}{8} = 24$ newton

$\because T = \frac{32 \times 10}{8} = 40$ newton



10

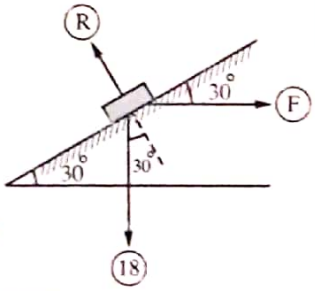
The body is in equilibrium under acting of three forces.

$\therefore$ Applying lami's rule

$\therefore \frac{18}{\sin 120°} = \frac{F}{\sin 150°} = \frac{R}{\sin 90°}$

$\therefore F = \frac{18 \times \sin 150°}{\sin 120°} = 6\sqrt{3}$ newton

$R = \frac{18 \times \sin 90°}{\sin 120°} = 12\sqrt{3}$ newton



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11 (d)

12

$\because$ Volume of the cone $= \frac{1}{3} \times \pi (2)^2 \times 12 = 16\pi$ cm^3.

$\therefore$ Volume of the dislodges water in the cylinder $= 16\pi$ cm^3.

$\therefore 16\pi = \pi r^2 \times 1$ $\quad \therefore r^2 = 16$

$r = 4$ cm.

$\therefore$ The length of the diameter of the base of the vessel $= 4 \times 2 = 8$ cm.

---

13 (b)

14

$X = 12\cos 0° + 9\cos 90°$

$+ 5\sqrt{2}\cos 135° + 7\sqrt{2}\cos 225° + 7\cos 270°$

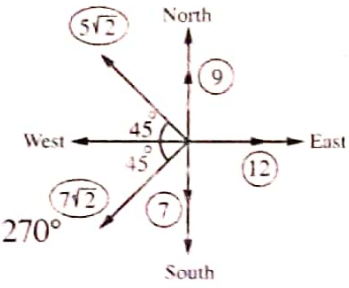
$= 12 + 0 - 5 - 7 + 0 = 0$

$\because Y = 12\sin 0° + 9\sin 90°$

$+ 5\sqrt{2}\sin 135°$

$+ 7\sqrt{2}\sin 225° + 7\sin 270°$

$= 0 + 9 + 5 - 7 - 7 = 0$



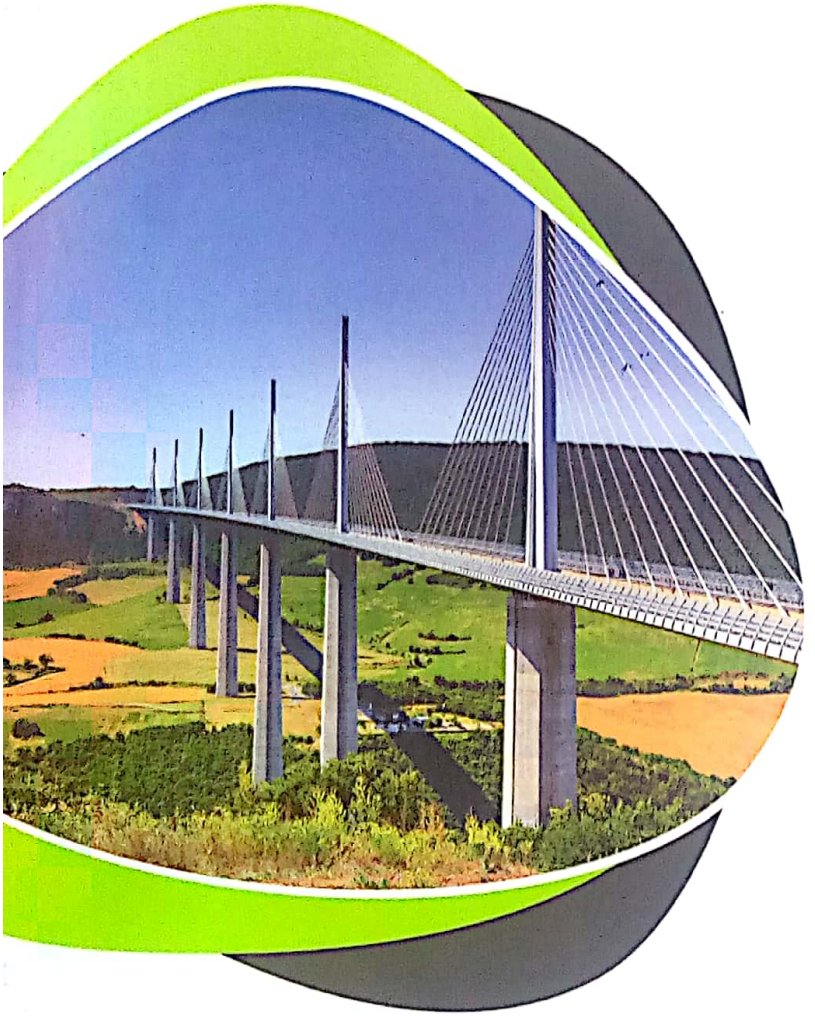
$\therefore \vec{R} = \vec{0}$

$\therefore$ The system is in equilibrium.

---

15 (a) $\quad$ **16** (a)

17 (d) $\quad$ **18** (d)



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