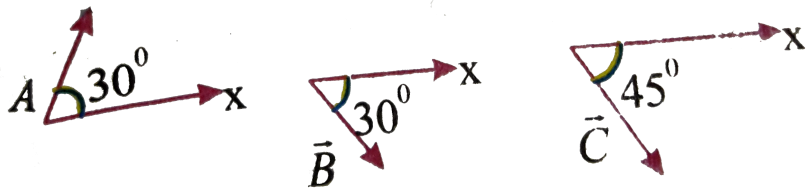
PHYSICS

COMPLETE CLASS 11TH + 12TH

VECTOR

Examples

1. Three vectors $\vec{A}$, $\vec{B}$, $\vec{C}$ are shown in the figure. Find angle between (i) $\vec{A}$ and $\vec{B}$ (ii) $\vec{B}$ and $\vec{C}$ (iii) $\vec{A}$ and $\vec{C}$.



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2. A physical quantity (m = 3kg) is multiplied by a vector $\vec{a}$ such that $\vec{F} = m\vec{a}$ .find the magnitude and direction of $\vec{F}$ if

(i) $\vec{a} = 3m/s^2$ East wards.

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3. A physical quantity (m = 3kg) is multiplied by a vector $\vec{a}$ such that $\vec{F} = m\vec{a}$ .find the magnitude and direction of $\vec{F}$ if

(ii) $\vec{a} = -4m/s^2$ North wards.

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4. Two vectors of 10 units & 5 units make an angle of 120° with each other.Find the magnitude & angle of resultant with vector of 10 unit magnitude.

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5. Two vectors of equal magnitude 2 are at an angle of 60° to each other find magnitude of thei. Sum & difference .

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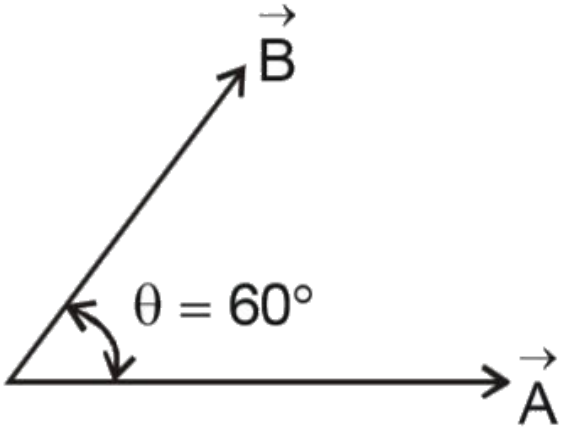
6. Find $\vec{A} + \vec{B}$ and $\vec{A} - \vec{B}$ in the diagram shown in figure. Given A = 4 units and B = 3 units.



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7. A unit vector along East is defined as $\hat{i}$. A force of 105 dynes acts west wards. Represent the force in terms of $\hat{i}$.

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8. Resolve the vector $A = A_x\hat{i} + A_y\hat{j}$ along an perpendicular to the line which make angle 60° with x-axis.

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9. Resolve a weight of 10N in two directions which are parallel and perpendiular to a slope inclined at 30° to the horizontal.

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10. Resolve horizontally and vertically a force f =8 N which makes an angle of 45° with the horizontal.

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11. Find the net displacement of a particle from its starting point if it undergoes two sucessive displacement given by $\vec{S}_1 = 20m, 37^\circ$ North of West , $\vec{S}_2 = 50m, 53^\circ$ North of East.

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12. Find magnitude of $\vec{B}$ and direction of $\vec{A}$. If $\vec{B}$ makes angle 37° and $\vec{C}$ makes 53° with x axis and $\vec{A}$ has magnitude equal to 10 and $\vec{c}$ has 5. $\left(\text{given } \vec{A} + \vec{B} + \vec{C} = 0\right)$

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13. Find the magnitude of F_1 and F_2. If F_1, F_2 make angle 30° and 45° with F_3 and magnitude of F_3 is 10 N. $\left(\text{given } \vec{F}_1 + F_2 = \vec{F}_3\right)$

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14. If two vectors $\vec{A}$ and $\vec{B}$ make angle 30° and 45° with their resultant and $\vec{B}$ has magnitude equal to 10, then find magnitude of $\vec{A}$.

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15. If $\vec{A}$ and $\vec{B}$ have angle between them equals to 60° and their resultant make, angle 45° with $\vec{A}$ and $\vec{A}$ have magnitude equal to 10. Then Find magnitude of $\vec{B}$.

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16. Obtain the magnitude of $2\vec{A} - 3\vec{B}$ if $\vec{A} = \hat{i} + \hat{j} - 2\hat{k}$ and $B = 2\hat{i} - \hat{j} + \hat{k}$.

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17. Find $\vec{A} + \vec{B}$ and $\vec{A} - \vec{B}$ if $\vec{A}$ make angle 37° with positive x-axis and $\vec{B}$ make angle 53° with negative x-axis as shown and magnitude of $\vec{A}$ is 5 and of B is 10.

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18. If vector $\vec{P} = a\hat{i} + a\hat{j} + 3\hat{k}$ and $\vec{Q} = a\hat{i} - 2\hat{j} - \hat{k}$ are perpendicular to each other , then the positive value of a is

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19. What is the component of $\left(3\hat{i} + 4\hat{j}\right)$ along $\left(\hat{i} + \hat{j}\right)$?

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20. The angle between the two vectors $\vec{A} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and $\vec{B} = 3\hat{i} + 4\hat{j} - 5\hat{k}$ will be :

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21. For what value of m of vector $\vec{A} = 2\hat{i} + 3\hat{j} - 6\hat{k}$ is perpendicular to $\vec{B} = 3\hat{i} - m\hat{j} + 6\hat{k}$.

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22. Find the component of vector $\vec{A} = 2\hat{i} + 3\hat{j}$ along the direction of $\hat{i} + \hat{j}$?

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23. The velocity of a particle is $\vec{v} = 3\hat{i} + 2\hat{j} + 3\hat{k}$.Find the vector component of the velocity along the line $\hat{i} - \hat{j} + \hat{k}$ and its magnitude.

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24. A $\vec{A}$ is East wards and $\vec{B}$ is downwards. Find the direction of $\vec{A} \times \vec{B}$?

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25. If $\vec{A} . \vec{B} = \left| \vec{A} \times \vec{B} \right|$, find angle between $\vec{A}$ and $\vec{B}$.

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26. Find $\vec{A} \times \vec{B}$ if $\vec{A} = \hat{i} - 2\hat{j} + 4\hat{k}$ and $\vec{B} = 2\hat{i} - \hat{j} + 2\hat{k}$

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27. $\vec{A}$ is North-East and $\vec{B}$ is down wards, find the direction of $\vec{A} \times \vec{B}$.

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28. Find $\vec{B} \times \vec{A}$ if $\vec{A} = 3\hat{i} - 2\hat{j} + 6\hat{k}$ and $\vec{B} = \hat{i} - \hat{j} + \hat{k}$.

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29. Suppose that the function f is defined for all real numbers r by the formula $f(r) = 2(r-1) + 3$. Evaluate f at the input values $0, 2, x+2$, and $f(2)$.

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30. A function $f(x)$ is defined as $f(x) = x^2 + 3$. Find $f(0), f(1), f(x^2), f(x+1)$ and $f(f(1))$.

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31. Find the derivatives of $y = (x^2+1)(x^3+3)$.

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32. Let y = uv be the product of the functions u and v. Find $y'(2)$ if $u(2) = 3, u'(2) = -4, v(2) = 1,$ and $v'(2) = 2.$

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33. Find the derivative of $y = \dfrac{t^2 - 1}{t^2 + 1}.$

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34. Find dy/dx if $y = \tan x.$

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35. The function $= 6x - 10 = 2(3x - 5)$ is the composite of the functions $y = 2u$ and $u = 3x - 5$. How are the derivatives of the derivaties of these three functions related ?

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36. Find the derivative of $y = \sqrt{x^2 + 1}$.

A. x √ x 2 + 1

B.

C. = x/(sqrt(x^2 + 1))`

D. cdot 2(x) = x/(sqrt(x^2 + 1))`

Answer:

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37. $\frac{d}{dx}(Ax + B)^n$

A. n (A x + B) n − 1 A

B. n (A x + B) n − 1 B

C. n (A x + B) n − 2 A

D. n (A x + B) n − 1

Answer: A

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38. $\frac{d}{dx}\sin(Ax+B) = \cos(Ax+B).\, A$

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39. $\frac{d}{dx}\log(Ax+B) = \frac{1}{Ax+B} \cdot A$

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40. $\frac{d}{dx}\tan(Ax+B) = \sec^2(Ax+B) \cdot A$

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41. $\frac{d}{dx}e^{Ax+B} = e^{Ax+B} \cdot A$

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42. If $f(x) = x\cos x$, find $f'(x)$.

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43. The area A of a circle is related to its diameter by the equation $A = \frac{\pi}{4}D^2$. How fast is the area changing with respect to the diameter when the diameter is 10 m ?

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Physical Example

1. Boyle's Law state that when a sample of gas is compressed at a constant temperature, the product of the pressure and the volume remains constant : $PV = C$. Find the rate of change of volume with respect to pressure.

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2. Find the average rate of change of the area of a circle with respect to its radius r as r changed from

(i) 2 to 3

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3. Find the average rate of change of the area of a circle with respect to its radius r as r changed from

(ii) 2 to 2.5

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4. Find the average rate of change of the area of a circle with respect to its radius r as r changed from

(iii) 2 to 2.1

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5. Find the instantaneous rate of change of the area of a circle when r=2.

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6. Show that thre rate of change of the area of a circle with respect to its radius (at any r) is equal to the circumference of the circle. Try to explain geometrically when this is true by drawing a circle whose radius is increased by an amount r. How can you approximate the resulting change in area ΔA if Δr is small ?

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7. Find maximum or minimum values of the functions

(a) $y = 25x^2 + 5 - 10x$

(b) $y = 9 - (x - 3)^2$

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8. Find the maximum or minimum values of the function.

$y = 9 - (x - 3)^2$

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9. Evaluate $\int 2x dx$

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10. Evaluate $\int \sqrt{x^2 + 2x + 5} dx$

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11. Using an area to evaluate a definite integral.

Evaluate $\int_z^b xdx0 < a < b.$

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Exercise 1

1. A man walks 40m North , then 30m East and then 40m South. Find the displacement from the starting point ?

A. 30m East

B. 60m East

C. 30m West

D. 30m West

Answer: A

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2. Two forces $\overrightarrow{F_1}$ and $\overrightarrow{F_2}$ are acting at right angles to each other , find their resultant ?

A. $\sqrt{F_1^2 - F_2^2}$

B. $\sqrt{F_1^2 + F_2^2}$

C. $\sqrt{(F_1 + F_2)}$

D. $F_1 + F_2$

Answer: B

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3. A vector of magnitude 30 and direction eastwards is added with another vector of magnitude 40 and direction Northwards . Find the magnitude and direction of resultant with the east.

A. $53, 53^\circ$ with East

B. $50, 53^\circ$ with West

C. $50, 53^\circ$ with East

D. $53, 53^\circ$ with West

Answer: C

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4. Two forces $\vec{F}_1 = 500N$ due east and $\vec{F}_2 = 250N$ due north have their common initial point. $\vec{F}_2 - \vec{F}_1$ is

A. $200\sqrt{5}N, \tan^{-1}(2)W\text{of}N$

B. $250\sqrt{5}N, \tan^{-1}(2)W\text{of}N$

C. $150\sqrt{5}N, \tan^{-1}(2)W\text{of}N$

D. $50\sqrt{5}N, \tan^{-1}(2)W\text{of}N$

Answer: B

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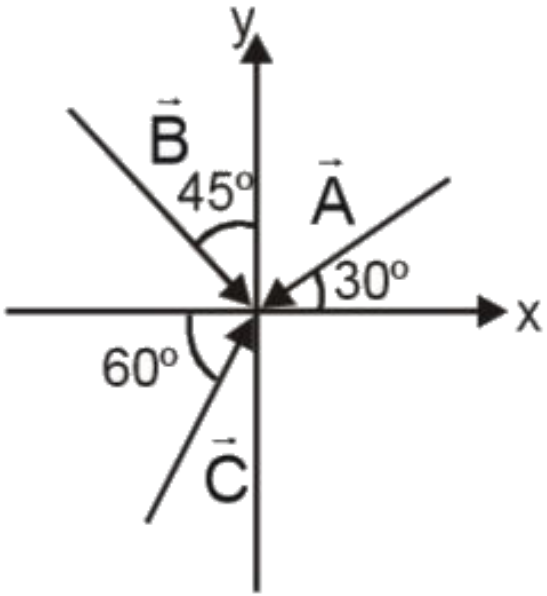
5. Vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are shown in figure . Find angle between



$\vec{A}$ and $\vec{B}$

A. 105°

B. 150°

C. 65°

D. 135°

Answer: A

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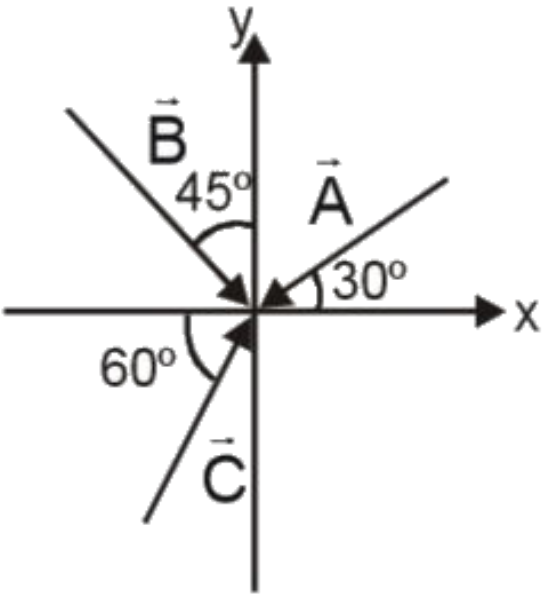
6. Vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are shown in figure . Find angle between



$\vec{A}$ and $\vec{C}$

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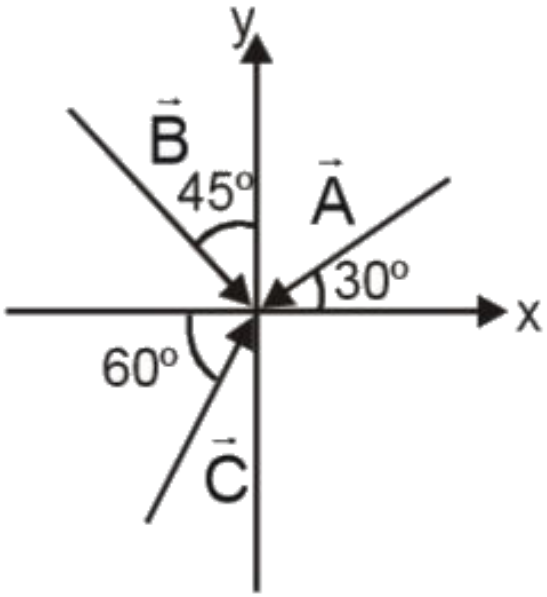
7. Vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are shown in figure . Find angle between



$\vec{B}$ and $\vec{C}$

A. 105°

B. 150°

C. 65°

D. 135°

Answer: A

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8. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors i.e. $\vec{A} + \vec{B} + \vec{C}$

A. can be zero

B. cannot be zero

C. lies in the plane of $\vec{A} + \vec{B}$

D. lies in the plane of $\vec{A} - \vec{B}$

Answer: B

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9. Vector sum of two forces of 10N and 6N cannot be:

A. 2N

B. 8N

C. 18N

D. 20N

Answer: B

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10. A set of vectors taken in a given order gives a closed polygon. Then the resultant of these vectors is a

A. scalar quantity

B. pseudo vector

C. unit vector

D. null vector

Answer: D

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11. The vector sum of two force P and Q is minimum when the angle θ between their positive directions , is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. π

Answer: D

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12. The vector sum of two vectors $\vec{A}$ and $\vec{B}$ is maximum , then the angle θ between two vector is

A. 0°

B. 30°

C. 45°

D. 60°

Answer: A

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13. Given : $\vec{C} = \vec{A} + \vec{B}$. Also , the magnitude of $\vec{A}$, $\vec{B}$ and $\vec{C}$ are 12,5 and 13 units respectively . The angle between $\vec{A}$ and $\vec{B}$ is

A. 0°

B. $\frac{\pi}{4}$

C. $\frac{\pi}{2}$

D. π

Answer: C

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14. If $\left|\vec{P}+\vec{Q}\right|=\left|\vec{P}-\vec{Q}\right|$ the angle between $\vec{P}$ and $\vec{Q}$ is

A. $\theta=0^{\circ}$

B. $\theta=90^{\circ}$

C. $P=0$

D. $Q=0$

Answer: B

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15. Find the torque of a force $\vec{F}=-3\hat{i}+2\hat{j}+\hat{k}$ acting at the point $\vec{r}=8\hat{i}+2\hat{j}+3\hat{k}$ about origin

A. $\sqrt{14}$

B. $\sqrt{10}$

C. $\sqrt{28}$

D. $\sqrt{5}$

Answer: A

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16. What are the x and then y components of a 25 m displacement at an angle of 210° with the x - axis (clockwise) ?

A. $-25\cos 30^\circ$ and $+25\sin 30^\circ$

B. $25\cos 30^\circ$ and $-25\sin 30^\circ$

C. $25\cos 30^\circ$ and $+25\sin 30^\circ$

D. $-25\cos 30^\circ$ and $-25\sin 30^\circ$

Answer: D

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17. One of the rectangular components of a velocity of $60\ \text{km}h^{-1}$ is $30\ \text{km}\ h^{-1}$. Find other rectangular component ?

A. $15\sqrt{3}kmh^{-1}$

B. $30\sqrt{6}kmh^{-1}$

C. $30\sqrt{3}kmh^{-1}$

D. $15\sqrt{6}kmh^{-1}$

Answer: C

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18. If $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = 2\hat{i} + \hat{j}$ find $\vec{A} . \vec{B}$

A. 6

B. 3

C. 9

D. 12

Answer: B

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19. If $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = 2\hat{i} + \hat{j}$ find $\vec{A} \times \vec{B}$

A. $-\hat{i} + 2\hat{j} + \hat{k}$

B. $-\hat{i} - 2\hat{j} - \hat{k}$

C. $-\hat{i} + 2\hat{j} - \hat{k}$

D. $\hat{i} + 2\hat{j} - \hat{k}$

Answer: C

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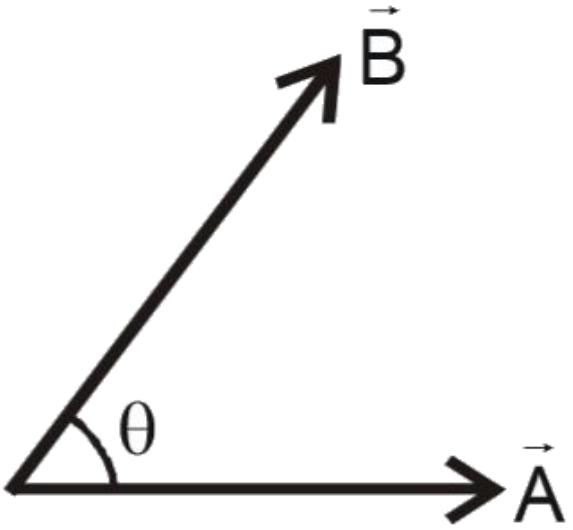
20. If $\left|\vec{A}\right| = 4, \left|\vec{B}\right| = 3$ and $\theta = 60^\circ$ in the figure . Find



$\vec{A} \cdot \vec{B}$

A. 6

B. 3

C. 9

D. 12

Answer: A

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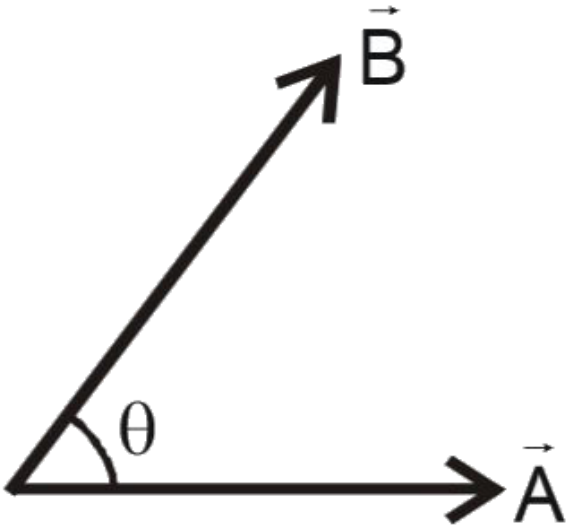
21. If $\left|\vec{A}\right| = 4, \left|\vec{B}\right| = 3$ and $\theta = 60^\circ$ in the figure . Find



$\left|\vec{A} \times \vec{B}\right|$

A. $3\sqrt{3}$

B. $2\sqrt{3}$

C. $6\sqrt{3}$

D. $3\sqrt{6}$

Answer: C

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22. If $0.5\hat{i} + 0.8\hat{j} + C\hat{k}$ is a unit vector. Find the value of C.

A. $\sqrt{0.33}$

B. $\sqrt{0.22}$

C. $\sqrt{0.11}$

D. $\sqrt{0.44}$

Answer: C

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23. The rectangular components of a vector are (2,2) . The corresponding rectangular components of another vector are $\left(1, \sqrt{3}\right)$. Find the angle between the two vectors.

A. 15°

B. 30°

C. 60°

D. 45°

Answer: A

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24. The x and y components of a a force are $2N \text{ and } -3N$. The force is

A. $2\hat{i} - 3\hat{j}$

B. $2\hat{i} + 3\hat{j}$

C. $-2\hat{i} - 3\hat{j}$

D. $3\hat{i} + 2\hat{j}$

Answer: A

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25. Assertion: If three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ satisfy the relation $\vec{A} . \vec{B} = 0 \& \vec{A} . veC = 0$ then the vector $\vec{A}$ may be parallel to $\vec{B} \times \vec{C}$.

A. $\vec{B}$

B. $\vec{C}$

C. $\vec{B} . \vec{C}$

D. $\vec{B} \times \vec{C}$

Answer: D

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26. The magnitude of scalar product of two vectors is 8 and of vector product is $8\sqrt{3}$. The angle between them is:

A. 30°

B. 60°

C. 120°

D. 150°

Answer: B

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27. Two forces of magnitude 1 N and 13 N resultant of magnitude $6\sqrt{5}N$, then that is the angle between two forces.

A. $\frac{\cos^{-1}.1}{13}$

B. $\frac{\cos^{-1}.5}{13}$

C. $\frac{\cos^{-1}.13}{5}$

D. $\frac{\cos^{-1}.13}{7}$

Answer: B

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28. The ratio of maximum and minimum magnitudes of the resultant of two vectors $\vec{A}$ and $\vec{b}$ is 3 : 1 . Now, $\left|\vec{a}\right|$ is equal to :

A. $\left|\vec{b}\right|$

B. $2\left|\vec{b}\right|$

C. $3\left|\vec{b}\right|$

D. $4\left|\vec{b}\right|$

Answer: B

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29. The angle made by the vector $\vec{A} = 2\hat{i} + 3\hat{j}$ with Y-axis is

A. $\tan^{-1}(3/2)$

B. $\tan^{-1}(2/3)$

C. $\sin^{-1}(2/3)$

D. $\sin^{-1}(3/2)$

Answer: B

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30. The vector joining the points A (1,1,-1) and B (2,-3,4) & pointing A to B is

A. $\hat{i}(-1) + 4\hat{j} - 5\hat{k}$

B. $\hat{i} + 4\hat{j} + 5\hat{k}$

C. $\hat{i} - 4\hat{j} + 5\hat{k}$

D. $\hat{i}(-1) - 4\hat{\hat{j}} - 5\hat{k}$

Answer: C

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31. $y = x^2 + x + 8$

A. $\frac{dy}{dx} = 2x - 1$

B. $\frac{dy}{dx} = x + 1$

C. $\frac{dy}{dx} = x - 1$

D. $\frac{dy}{dx} = 2x + 1$

Answer: D

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32. $s = 5t^3 - 3t^5$

A. $\frac{ds}{dt} = 15t^2 + 15t^4$

B. $\frac{ds}{dt} = 15t^2 - 5t^4$

C. $\frac{ds}{dt} = 15t^2 - 15t^4$

D. $\frac{ds}{dt} = 15t^2 + 5t^4$

Answer: C

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33. $y = 5\sin x$

A. $\frac{dy}{dx} = 5\cos x$

B. $\frac{dy}{dx} = \cos x$

C. $\frac{dy}{dx} = 25\cos x$

D. $\frac{dy}{dx} = 10\cos x$

Answer: A

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34. Differentiate x sin x

A. $\sin x - x \cos x$

B. $\sin x + 2x \cos x$

C. $\sin x + x \cos x$

D. $\sin 2x - 2x \cos x$

Answer: C

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35. $y = e^x \ln x$

A. $e^x \ln x - \frac{e^x}{x}$

B. $e^x \ln x - \frac{2e^x}{x}$

C. $2e^x \ln x - \frac{e^x}{x}$

D. $e^x \ln x + \frac{e^x}{x}$

Answer: D

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36. $y = (x-1)\left(x^2+x+1\right)$

A. $\frac{dy}{dx} = 2x^2$

B. $\frac{dy}{dx} = 3x^2$

C. $\frac{dy}{dx} = 5x^2$

D. $\frac{dy}{dx} = 3x$

Answer: B

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37. Differentiate y = (sinx)/(cosx)`

A. $2\sec^2 x$

B. $3\sec^2 x$

C. $4\sec^2 x$

D. $\sec^2 x$

Answer: D

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38. $y = \dfrac{2x+5}{3x-2}$

A. $y' = \dfrac{-19}{((3x-2))^2}$

B. $y' = \dfrac{19}{(3x-2)^2}$

C. $y' = \dfrac{19}{(3x+2)^2}$

D. $y' = \dfrac{-19}{(3x+2)^2}$

Answer: A

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39. If $y = \frac{\ln x}{x}$ "then" $\frac{dy}{dx}$ will be:

A. $\frac{1}{x^2} - \frac{\ln x}{x^2}$

B. $\frac{1}{x^2} + \frac{\ln x}{x^2}$

C. $\frac{1}{x^2} - \frac{2\ln x}{x^2}$

D. $\frac{1}{x^2} - \frac{\ln x}{2x^2}$

Answer: A

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40. Find $\frac{dy}{dx}$ as a function of x

$y = (2x + 1)^5$

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41. Find $\frac{dy}{dx}$ as a function of x

$y = (4 - 3x)^9$

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42. Find $\frac{dy}{dx}$ as a function of x

$y = \left(1 - \frac{x}{7}\right)^{-7}$

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43. Particle 's position as a function of time is given by $x = -t^2 + 4t + 4$ find the maximum value of position coordinate of particle.

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44. Find the maximum and minimum values of function $2x^3 - 15x^2 + 36 + 11$

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45. If velcotiy of a particle is given by $v = 2t - 1$ then find the acceleration of particle at t = 2s.

A. 2

B. 4

C. 8

D. 6

Answer: B

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46. Position of a particle moving along a straight line is given by $x = 2t^2 + t$. Find the velocity at t = 2 sec.

A. 3

B. 6

C. 4

D. 9

Answer: D

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47. If velocity of a particle is given by $v = 2t^2 - 2$ then find the acceleration of particle at t = 2 s.

A. 0

B. 2

C. 4

D. 8

Answer: D

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48. The minimum value of $y = 2x^2 - x + 1$ is

A. $-\frac{3}{8}$

B. $-\frac{5}{8}$

C. $\frac{7}{8}$

D. $-\frac{9}{8}$

Answer: C

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49. If $S = \frac{t^3}{3} - 2t^2 + 3t + 4$, then

A. at t = 1 , S is minimum

B. at t = 1 , S is maximum

C. at t = 3 , S is maximum

D. at t = 2 , S is minimum

Answer: B

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50. If $y = 4x^2 - 4x + 7$. Find the minimum value of y .

A. 6

B. 8

C. 2

D. 4

Answer: A

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51. If $y = x^3 - 3x$. Find the maximum value of y.

A. 8

B. 6

C. 4

D. 2

Answer: D

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52. If $y = x^3 - 3x$. Find the value of x at which we get minimum value of y .

A. 4

B. 1

C. 3

D. 2

Answer: B

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53. Find interals of given functions

2x

Watch Video Solution

54. Find interals of given functions

x^2

Watch Video Solution

55. Find interals of given functions

$x^2 - 2x + 1$

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56. Find interals of given functions

$-3x^{-4}$

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57. Find interals of given functions

x^{-4}

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58. Find integral of given function

$x^{-4}+2x+3$

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59. Find integral of given function

$$\frac{1}{x^2}$$

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60. Find interals of given functions

$$\frac{5}{x^2}$$

Watch Video Solution

61. Find integral of given function

$$2 - \frac{5}{x^2}$$

Watch Video Solution

62. Find integral of given function

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

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63. Find interals of given functions

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

Watch Video Solution

64. Find interals of given functions

$$\sqrt{x}+\frac{1}{\sqrt{x}}$$

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65. Find interals of given functions

$$\frac{4}{3}\sqrt[3]{x}$$

Watch Video Solution

66. Find integral of given function

$$\frac{1}{3\sqrt[3]{x}}$$

Watch Video Solution

67. Find interals of given functions

$$\sqrt[3]{x}+\frac{1}{\sqrt[3]{x}}$$

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68. Find integral of given function

$$\frac{1}{2}x^{-1/2}$$

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69. Find integral of given function

$$-\frac{1}{2}x^{-3/2}$$

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70. Find integral of given function

$$-\frac{3}{2}x^{-5/2}$$

View Text Solution

71. Find integral of given function

$$\left(1-x^2-3x^5\right)$$

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72. Find integral of given function

3 sinx

Watch Video Solution

73. Find interals of given functions

$$\frac{1}{3x}$$

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74. Integrate by using the substitution suggested in bracket.

$$\int_{-2}^{1} 5dx$$

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75. Integrate by using the substitution suggested in bracket.

$$\int_{-4}^{-1} \frac{\pi}{2} dth\eta$$

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76. Integrate by using the substitution suggested in bracket.

$$\int_{-2}^{4} \left(\frac{x}{2} + 3\right) dx$$

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Exercise 2 Level I Objective Problems

1. Vector vec(A) points N - E and its magnitude is $3kgms^{-1}$ it is multiplied by the scalar λ such that $\lambda = -4$ second . Find the magnitude of the new vector quantity.

A. 9

B. 12

C. 19

D. 15

Answer: B

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2. A hall has the dimensions $10m \times 12m \times 14m$. A fly starting at one corner ends up at a diagonally opposite corner. What is the magnitude of its displacement

A. 16 m

B. 17 m

C. 18 m

D. 21 m

Answer: D

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3. A vector is not changed if

A. it is displaced parallel to itself

B. It is rotated through an arbitrary angle

C. It is cross - multiplied by a unit vector

D. It is multiplied by an arbitrary scalar

Answer: A

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4. The angle θ between directions of forces $\vec{A}$ and $\vec{B}$ is 90° where A = 8 dyne and B = 6 dyne . If the resultant $\vec{R}$ makes an angle α with $\vec{A}$ then find the value of $'\alpha'$?

A. 47°

B. 27°

C. 37°

D. 12°

Answer: C

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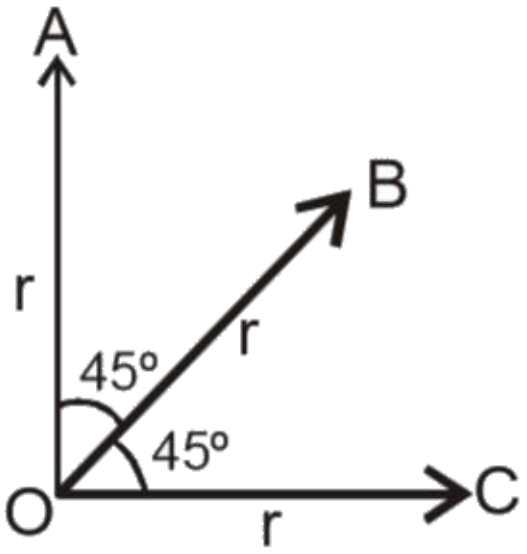
5. Find the resultant of three vectors $\vec{OA}, \vec{OB}, \vec{OC}$ each of magnitude r as shown in figure.



A. $r\left(1-\sqrt{2}\right)$

B. $2r\left(1+\sqrt{2}\right)$

C. $r\left(1+\sqrt{2}\right)$

D. 2r(1 - sqrt(2))`

Answer: C

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6. If the angle between two forces increases, the magnitude of their resultant

A. decreases

B. increases

C. remains unchanged

D. first decreases and then increases

Answer: A

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7. If $\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = \hat{i} + \hat{j} + 2\hat{k}$ then find out unit vector along $\vec{A} + \vec{B}$.

A. $\frac{4\hat{i} + 5\hat{j} - 2\hat{k}}{\sqrt{45}}$

B. $\frac{4\hat{i} - 5\hat{j} - 2\hat{k}}{\sqrt{45}}$

C. $\frac{2\hat{i}+5\hat{j}+2\hat{k}}{\sqrt{45}}$

D. $\frac{4\hat{i}+5\hat{j}+2\hat{k}}{\sqrt{45}}$

Answer: D

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8. Vector $\vec{A}$ is $2cm$ long and is 60° above the x-axis in the first quadrant. Vector $\vec{B}$ is $2cm$ long and is 60° below the x-axis in the fourth quadrant. The sum $\vec{A}+\vec{B}$ is a vector of magnitudes

A. $2\text{along}+y\text{axis}$

B. $2\text{along}+x-\text{axis}$

C. $1\text{along}+x-\text{axis}$

D. $2\text{along}-x-\text{axis}$

Answer: B

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9. Six forcees, 9.81 N each, acting at a point are coplaner. If the angles between neighbouring forces are equal, then the resultant is

A. 0 N

B. 9. 81 N

C. $2 \times 9.81N$

D. $3 \times 9.81N$

Answer: A

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10. If $\vec{a} = x_1\hat{i} + y_1\hat{j} \& \vec{b} = x_2\hat{i} + y_2\hat{j}$. The condition that would make $\vec{a} \& \vec{b}$ parallel to each other is _____.

A. $\frac{x_1}{x_2} = \frac{y_1}{y_2}$

B. $\frac{x_1}{x_2} < \frac{y_1}{y_2}$

C. $\frac{x_1}{x_2} > \frac{y_1}{y_2}$

D. $\frac{x_1}{x_2} \geq \frac{y_1}{y_2}$

Answer: A

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11. A vector $\overrightarrow{A}$ points vertically upward and $\overrightarrow{B}$ points towards north. The vector produce $\overrightarrow{A} \times \overrightarrow{B}$ is

A. along west

B. along east

C. zero

D. none of these

Answer: D

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12. Given : $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = 5\hat{i} - 6\hat{j}$. The magnitude of $\vec{A} + \vec{B}$ is

A. 4 units

B. 10 units

C. $\sqrt{58}$ units

D. $\sqrt{61}$ units

Answer: C

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13. Given : $\vec{A} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{B} = -\hat{i} - \hat{j} + \hat{k}$. The unit vector of $\vec{A} - \vec{B}$ is

A. $\frac{3\hat{i} + \hat{k}}{\sqrt{10}}$

B. $\frac{3\hat{i}}{\sqrt{10}}$

C. $\frac{3\hat{k}}{\sqrt{10}}$

D. $\frac{3\hat{i} - \hat{k}}{\sqrt{10}}$

Answer: A

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14. Find $\frac{dy}{dx}$ as a function of x

$y = \left(\frac{x}{2} - 1\right)^{-10}$

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15. Find $\frac{dy}{dx}$ as a function of x

$y = \sin 5x$

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16. If $y = \sin(x) + \text{in}\left(x^2\right) + e^{2x} \text{then} \frac{dy}{dx}$ will be :

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17. If $y = 2\sin(\omega t + \phi)$ where ω and ϕ constants then $\frac{dy}{dt}$ will be

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18. Find the first derivative and second derivative of given function w.r.t the independent variable x.

$y = lnx^2 + \tan x.$

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19. Find the first derivative and second derivative of given function w.r.t the independent variable x.

$y = \sqrt[7]{x} + \tan x$

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20. Find derivative of $e^x \tan x$

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21. Find the derivative of given functions w.r.t the corresponding independent varible.

$y = x^2 \sin^4 x + x \cos^{-2} x.$

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22. Find the derivative of given functions w.r.t the corresponding independent varible.

$y = \left(x + \frac{1}{x}\right)\left(x - \frac{1}{x} + 1\right)$

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23. Find the derivative of given functions w.r.t the corresponding independent varible.

$y = \frac{\cot x}{1 + \cot x}$

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24. Given $y = f(u)$ and $u = g(x)$ Find $\frac{dy}{dx}$ if $y = 2u^3, u = 8x - 1$

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25. Given $y = f(u)$ and $u = g(x)$. Find $\frac{dy}{dx}$.

$y = \sin u, u = 3x + 1$

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26. The displacement of body is given by $s = 4 + 2t^4$. The acceleration of the body at the end of 1 s from the start is :

A. $24m/\sec^2$

B. $10m/\sec^2$

C. $15m/\sec^2$

D. $12m/\sec^2$

Answer: A

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27. Momentum of a body moving in a straight line is $p = \left(2t^3 + t^2 + 1\right)$ kg m/s. Force (dp/dt) acting on a body at $t = 2$ sec.

A. 6N

B. 28N

C. 4N

D. 2N

Answer: B

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28. Momentum of a body moving in a straight line is $p = \left(2t^3 + t^2 + 2t + 1\right) kg$ m/s. Force acting on a body at $t = 2$ sec.

A. 16 N

B. 18N

C. 20 N

D. 30 N

Answer: D

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29. The charge flowing throug a conductor beginning with time to=0 is given by the formula $q = 2t^2 + 3t + 1$ (coulombs). Find the current $i = \frac{dq}{dt}$ at the end of the 5th seconds.

A. $23A$

B. $25A$

C. $27A$

D. $29A$

Answer: A

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30. A body whose mass is 3kg performs rectilinear motion according to the formula $s = 1 + t + t^2$, where s is measured the kinetic energy $\frac{1}{2}mv^2$ and t in second.

Determine the kinetic energy $\frac{1}{2}mv^2$ of the body in $5\,\sec$ after its start.

A. 1.815×10^5 erg

B. 1.815×10^7 erg

C. 1.715×10^{15} erg

D. 1.815×10^8 erg

Answer: A

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31. The angle θ through which a pulley turns with time t is specified by the function$\theta = t^2 + 3t - 5$. Find the angular velocity $\omega = \dfrac{d\theta}{dt}$ at $t = 5\text{sec}$.

A. $15Rad/\sec$

B. $23Rad/\sec$

C. $13Rad/\sec$

D. $11Rad/\sec$

Answer: C

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32. If the distance s travelled by a body in time t is given by $s = \dfrac{a}{t} + bt^2$ then the acceleration equals

A. $\dfrac{2a}{t^3} + 2b$

B. $\dfrac{2s}{t^2}$

C. $2b - \dfrac{2a}{t^3}$

D. $\frac{s}{t^2}$

Answer: A

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33. If $v = 3t^2 - 2t + 1$, find the value of t for which $\frac{dv}{dt} = 0$

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $\frac{3}{2}$

D. none

Answer: A

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34. Find two positive numbers x & y such that $x + y = 60$ and xy is maximum.

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35. A sheet of area $40m^2$ is used to make an open tank with square base. Find the dimensions of the base such that the volume of this tank is maximum.

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36. Find integrals of given functions

$$\int (2x^3 - 5x + 7)\, dx$$

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37. Find integrals of given functions

$$\int\left(\frac{1}{5}-\frac{2}{x^3}+2x\right)dx$$

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38. Find integrals of given functions

$$\int\left(\sqrt{x}+\sqrt[3]{x}\right)dx$$

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39. Find integrals of given functions

$$\int x^{-3}(x+1)dx$$

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40. Find integrals of given functions

$$\int\frac{t\sqrt{t}+\sqrt{t}}{t^2}dt$$

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41. Find integrals of given functions

$$\int \frac{4+\sqrt{t}}{t^3} dt$$

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42. Find integrals of given functions

$$\int \cos\theta(\tan\theta + \sec\theta) d\theta$$

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43. Find integrals of given functions

$$\int_x^{2\pi} \theta d\theta$$

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44. Find integrals of given functions

$$\int_0^{\sqrt[3]{7}} \theta dth\eta$$

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45. Find integrals of given functions

$$\int_0^{\pi} \cos x dx$$

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46. Find integrals of given functions

$$\int_0^1 \frac{dx}{3x+2}$$

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47. Use a definite integral to find the area of the origin between the given curve and the x-axis on the interval [0,b]

$y = 3x^2$

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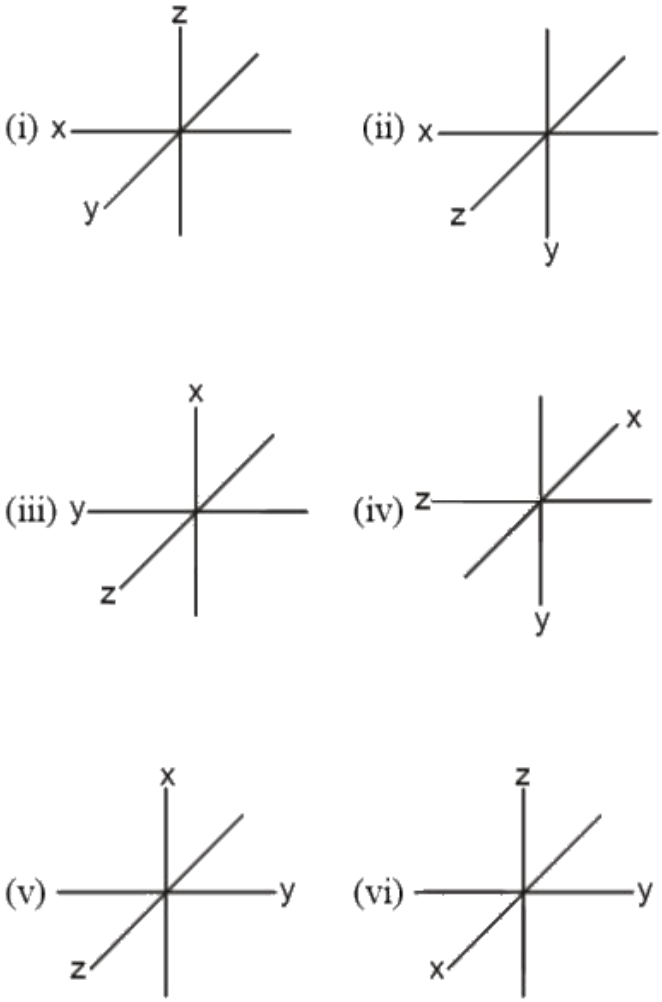
Exercise 2 Level Ii Multiple Correct

1. Which of the arrangement of axes in fig . Can be labelled "right handed coordinate system" ? As usual, each axis lable indicates the positive side

of the axis.



A. (i), (ii)

B. (iii) (iv)

C. (iv)

D. (v)

Answer: A::B::C

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2. Vector $\vec{A} - \vec{B}$ represents -

A. Addition of vector $\vec{A}$ and vector $-\vec{B}$.

B. Resultant of vector $\vec{A}$ and $\vec{B}$

C. Resultant of vector $\vec{A}$ and $-\vec{B}$

D. None of these

Answer: A::C

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3. If $\vec{a}$ and $\vec{b}$ are two vector with $\left|\vec{a}\right| = \left|\vec{b}\right|$ and $\left|\vec{a} + \vec{b}\right| + 2\left|\vec{a}\right|$,then angle between $\vec{a}$ and $\vec{b}$.

A. 0°

B. 90°

C. 60°

D. 180°

Answer: A::D

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4. A vector is euqally inclineed to all of the coordintates axes then the angle made by it with x - axis is theta then -

A. $\cos\theta = \frac{2}{\sqrt{3}}$

B. $\cos\theta = \frac{1}{\sqrt{3}}$

C. $\sin\theta = \frac{2}{\sqrt{3}}$

D. $\sin\theta = \frac{1}{\sqrt{3}}$

Answer: B

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5. Vector $\vec{R}$ is the resultant of the vetors $\vec{A}$ and $\vec{B}$. Ratio of maximum value of $\left|\vec{R}\right|$ to the minimum value of $\left|\vec{R}\right|$ is $\frac{3}{1}$. The $\frac{\left|\vec{A}\right|}{\left|\vec{B}\right|}$ may be equal to-

A. $\frac{2}{1}$

B. $\frac{1}{2}$

C. $\frac{4}{1}$

D. $\frac{3}{1}$

Answer: A::B

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6. A man is walking toward east with a velocity of 8 km/h. Wind is blowing toward north - east at angle of 45°. To the man wind appears to blow of angle of 60° north of west.

A. True velocity of wind is $\frac{8\sqrt{6}}{1+\sqrt{3}}$ km/hr

B. Velocity of wind relative to man is $\frac{16}{1+\sqrt{3}}$ km/h

C. True velocity of wind is $\frac{\sqrt{6}}{1+\sqrt{3}}$ km/h

D. Velocity of wind relative to man is $\frac{8\sqrt{3}}{1+\sqrt{3}}$ km/h

Answer: A::B

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7. The magnitude of the vector product of two vectors $\vec{A}$ and $\vec{B}$ may not be:

A. greater than AB

B. equal to AB

C. less than AB

D. equal to zero

Answer: B::C::D

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8. The magnitudes of vectors $\vec{A}, \vec{B}$ and $\vec{C}$ are 3,4 and 5 units respectively. If $\vec{A} + \vec{B} = \vec{C}$, the angle between $\vec{A}$ and vecB` is

A. 90° if $C2 = A^2 + B^2$

B. Greater than 90° if $C^2 > A^2 + B^2$

C. Greater than 90° if $C^2 > A^2 + B^2$

D. Less than 90° if $C^2 > A^2 + B^2$

Answer: A::B::D

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9. The x-component of the resultant of several vectors

A. is equal to the sum of the x - components of the vectors

B. may be smaller than the sum of the magnitudes of the vectors

C. may be greater than the sum of the magnitudes of the vectors

D. may be equal to the sum of the magnitudes of the vectors

Answer: A::B::D

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10. The magnitude of the vector $\hat{i} + x\hat{j} + 3\hat{k}$ is half of the magnitude of vector $\hat{i} + x\hat{j} + 3\hat{k}$ The values of x are

A. $-2/3$

B. $1/3$

C. $2/3$

D. 2

Answer: A::D

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11. A displacement vector of magnitude 10 m has its initial point (4,3) m. They y - component of this vector has magnitude of 6m . The co-ordinates of the final point of the vector may be

A. $(-4, 9)m$

B. $(-4, -3)m$

C. $(12, 9)m$

D. $(12, -3)m$

Answer: A::C

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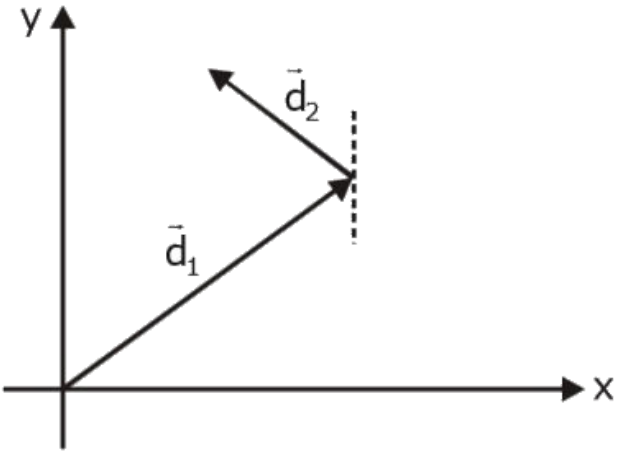
12. Which of the following statements is / are correct ?



A. the sign of the x - components of $vexd_1$ is positive and that of $\overrightarrow{d}_2$ is negative.

B. The signs of the y - components of $\overrightarrow{d}_1$ and $\overrightarrow{d}_2$ are positive and negative , respectively.

C. The signs of the x and y - components of $\overrightarrow{d}_1 + \overrightarrow{d}_2$ are positive .

D. None of these

Answer: A::C

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13. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane, another vector $\vec{C}$ lies outside this plane, then the resultant of these three vectors i.e. $\vec{A} + \vec{B} + \vec{C}$

A. Cannot be zero

B. Can be zero

C. lies in the plane of $\vec{A}$ or $\vec{B}$

D. Lies in a plane different from that of any of the three vectors

Answer: A::D

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Exercise 3 Level I Subjective

1. The resultant of two forces F_1 and F_2 is P. If F_2 is reversed , then resultant is Q . Then the value of $\left(P^2+Q^2\right)$ in terms of F_1 and F_2 is

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2. A man moves towards 3m north then 4 m towards east and finally 5 m towards 37° south of west. His displacement from origin is :-

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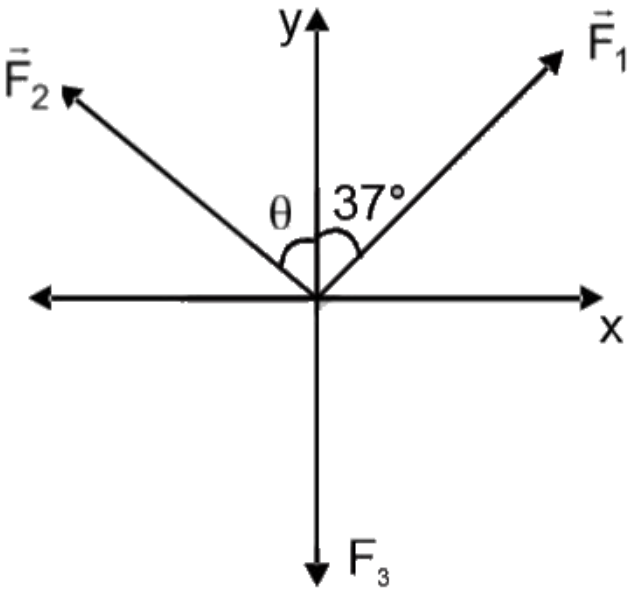
3. A body acted upon by 3 given forces is under equilibrium .

(a) If $\left|\vec{F}_1\right| = 10$ Nt., $\left|\vec{F}_2\right| = 6$ Nt Find the values of $\left|\vec{F}_3\right|$ & angle (θ) .

(b) Express $\overrightarrow{F}_2$ in unit vector form



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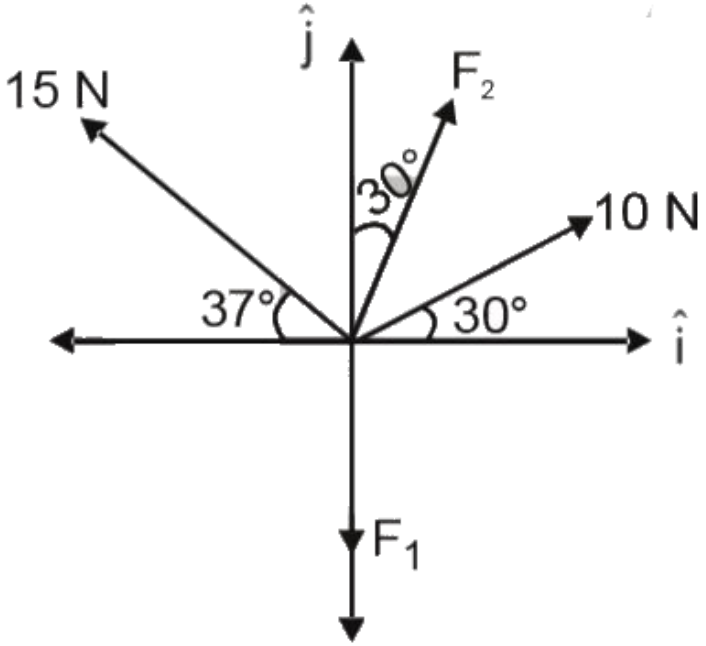
4. If the four forces as shown are in equilibrium Express $\overrightarrow{F}_1 \& \overrightarrow{F}_2$ in unit vector form.



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5. ABCDEF is a regular hexagon with point O as centre. The value of $\overrightarrow{AB} + \overrightarrow{AC} + \overrightarrow{AD} + \overrightarrow{AE} + \overrightarrow{AF}$ is

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6. In the regular hexagon shown in figure $\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CD}+\overrightarrow{DE}+\overrightarrow{EF}+\overrightarrow{AF}$ can be expressed as :

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7. Let O be the centre of the regular hexagon ABCDEF then find $\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OD}+\overrightarrow{+}(OE)+\overrightarrow{OF}$

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8. A particle is displaced from a position $2\hat{i}-\hat{j}+\hat{k}(m)$ to another position $3\hat{i}+2\hat{j}-2\hat{k}(m)$ under the action of a force $2\hat{i}+\hat{j}-\hat{k}(N)$. The work done by the force is

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9. Find derivative of given functions w.r.t the respective independent variable .

$y = \frac{\cos x}{x} + \frac{x}{\cos x}$

Find $\frac{dy}{dx}$ as a function of x

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10. Find derivative of given functions w.r.t the respective independent variable .

$y = \sin^3 x + \sin 3x$

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11. Find derivative of given functions w.r.t the respective independent variable .

$q = \sqrt{2r - r^2}$, find $\frac{dq}{dr}$

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12. Find derivative of given functions w.r.t the respective independent variable .

$$y = \left(\frac{x^2}{8} + x - \frac{1}{x}\right)^4$$

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13. Integrate by using the substitution suggested in bracket.

$$\int_{\sqrt{2}}^{5\sqrt{2}} r \quad \mathrm{dr}$$

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14. Integrate by using the substitution suggested in bracket.

$$\int_0^{2\pi} \sin\theta d\theta$$

Watch Video Solution

15. Integrate by using the substitution suggested in bracket.

$$\int_0^1 e^x dx$$

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Exercise 3 Level Ii Subjective

1. If the resultannt of two forces of magnitudes P and Q acting at a ponit at an angle of 60° is $\sqrt{7}Q$, then P/Q is

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2. If particle is acted upon by the forces $\vec{F}_1 = 2\hat{i} + 2\hat{j} - 3\hat{k}$ $\vec{F}_2 = 5\hat{i} + c\hat{j} - b\hat{k}$ $\vec{F}_3 = b\hat{i} + 5\hat{j} - 7\hat{k}$, $\vec{F}_4 = c\hat{i} + 6\hat{j} - a\hat{k}$. Find the values of the constant a, b, c in ordre that the particle will be in equilibrium.

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3. Find derivative of given functions w.r.t the corresponding independent variable.

y=x^2 cosx-2xsinx-2cosx

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4. Find derrivative of given functions w.r.t the corresponding independent variable.

$r = (1 + \sec\theta)\sin\theta.$

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5. Find two positive numbers x & y such that $x + y = 60$ and xy is maximum.

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6. A sheet of area $40m^2$ is used to make an open tank with square base. Find the dimensions of the base such that the volume of this tank is maximum.

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7. Use a definite integral to find the area of the region between the given curve and the x-axis on the interval [0, b]

$y = 2x$

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8. Use a definite integral to find the area of the region between the given curve and the x-axis on the interval [0, b]

$y = \frac{x}{2} + 1$

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Exercise 4 Level I Previous Year

1. Match the statements given in column-I with statements given in column-II

Column - I	**Column - II**
(A) If $\lvert\vec{A}\rvert=\lvert\vec{B}\rvert$ and $\lvert\vec{A}+\vec{B}\rvert=\lvert\vec{A}\rvert$ then angle between $\vec{A}$ and $\vec{B}$ is	(p) 90°
(B) Magnitude of resultant of two forces $\lvert\vec{F}_1\rvert=8\text{N}$ and $\lvert\vec{F}_2\rvert=4\text{N}$ may be	(q) 120°
(C) Angle between $\vec{A}=2\hat{i}+2\hat{j}$ & $\vec{B}=3\hat{k}$ is	(r) 12 N
(D) Magnitude of resultant of vectors $\vec{A}=2\hat{i}+\hat{j}$ & $\vec{B}=3\hat{k}$ is	(s) $\sqrt{14}$

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2. Position of particle is given by $S = t^3 - 2t^2 + 5t + 4$

(a) Find the position of particle at $t = 1$ sec

(b) Find the first derivative of S at $t = 1$ sec

(c) Find the second derivative of S $t = 1$ sec

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3. Two forces $\vec{F}_1 = 2\hat{i} + 2\hat{j}N$ and $\vec{F}_2 = 3\hat{i} + 4\hat{k}N$ are acting on a particle

(a) Find the resultant force acting on particle

(b) (b) Find the angle between $\vec{F_1} \& \vec{F_2}$

(c) Find the componant of force $\vec{F_1}$ along force $\vec{F_2}$.

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4. Assertion: A vector qunatity is a quantity that has both magnitude and a direction and obeys the triangle law of addition or equivalentyly the parallelogram law of addition.

Reason: The magnitude of the resultant vector of two given vectors can never be less than the magnitude of any of the given vector.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: C

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5. Statement-1 : If the rectangular components of a force are 8 N and 6 N, then the magnitude of the force is 10 N.

Statement-2 : If $\left|\vec{A}\right| = \left|\vec{B}\right| = 1$then $\left|\vec{A} \times \vec{B}\right|^2 + \left|\vec{A} . \vec{B}\right|^2 = 1$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: B

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6. If three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ satisfy the relation $\vec{A} . \vec{B} = 0 \& \vec{A} . \vec{C} = 0$ then the vector $\vec{A}$ is parallel to $\vec{B} \times \vec{C}$.

Statement-2 : $\vec{A} \perp \vec{B}$ and $\vec{A} \perp \vec{C}$ hence A is perpendicular to plane formed by $\vec{B}$ and $\vec{C}$.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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7. Assertion: The minimum number of vectors of unequal magnitude required to produce zero resultant is three.

Reason: Three vectors of unequal magnitude which can be represented by the three sides of a triangle taken in order, produce zero resultant.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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8. Statement-1 : The angle between the two vectors $\left(\hat{I}+\hat{J}\right)$ and $\left(\hat{k}\right)$ is $\frac{\pi}{2}$ radian.

Statement - 2 : Angle between two vectors $\overrightarrow{A}$ and $\overrightarrow{B}$ is given by $\theta=\cos^{-1}\left(\frac{A.B}{AB}\right)$

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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9. Assertion : Distance is a scalar quantity.

Reason : Distance is the length of path traversed.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: D

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10. State true or false

If $\vec{A}$ &$\vec{B}$ are two force vectors $\vec{A} . \vec{B} = \vec{B} . \vec{A}$.

Watch Video Solution

11. State true or false

If $\vec{A}$ &$\vec{B}$ are two force vectors then $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$.

Watch Video Solution

12. State true or false

If the vector product of two non-zero vectors vanishes, the vectors are collinear

Watch Video Solution

13. State true or false

If a function has maximum value at point P theh slope of tangent drawn

on function at point P is zero.

Watch Video Solution

14. The scalar product of vector $\vec{A} = 2\hat{i} + 5\hat{k}$ and $\vec{B} = 3\hat{j} + 5\hat{k}$ is .....

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15. If $\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = 7\hat{i} + 24\hat{j}$, find a vector having the same magnitude as $\vec{B}$ and parallel and same direction as $\vec{A}$.

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16. If $\vec{A} \mid \mid \vec{B}$ then $\vec{A} \times \vec{B}$ =.....

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17. The magnitude of area of the parellelogram formed by the adjacent sides of vectors $\vec{A} = 3\hat{i} + 2\hat{j}$ and $\vec{B} = 2\hat{i} - 2\hat{k}$ is.....

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18. A force is represented by $2\hat{i} + 3\hat{j} + 6\hat{k}$. The magnitude of the force is .....

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19. The unit vector along vector $\hat{i} + \hat{j} + \hat{k}$ is .....

Watch Video Solution

20. If $\vec{A}$ is .....to $\vec{B}$, then $\vec{A} . \vec{B} = 0$

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21. The angle made by the vector $\vec{A} = \hat{i} + \hat{j}$ with x-axis is

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22. If $\vec{A} + \vec{B} + \vec{C} = \vec{0}$, then $\vec{A} . \left(\vec{B} \times \vec{C} \right)$ = ...

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Exercise 4 Level Ii Previous Year

1. Three forces P,Q and R are acting at a point in the plane. The angle between P & Q and Q & R are $150^\circ \& 120^\circ$ respectively, then for equilibrium, forces P,Q & R are in the ratio

A. $1:2:3$

B. $1:2:\sqrt{3}$

C. $3:2:1$

D. $\sqrt{3}:2:1$

Answer: D

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2. A man rows a boat with a speed of 18 km/hr in northwest direction. The shoeline makes an angle of 15° south of west. Obtain the component of the velocity of the boat along the shoreline:

A. 9km/hr

B. $18\frac{\sqrt{3}}{2}km/hr$

C. $18\cos 15^\circ k\frac{m}{h}r$

D. $18\cos 75^\circ$ km/hr

Answer: A

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3. A bird moves from point $(1, -2, 3)$ to $(4, 2, 3)$. If the speed of the bird id $10m/s$, then the velocity of the bird is :-

A. $5\left(\hat{i} - 2\hat{j} + 3\hat{k}\right)$

B. $5\left(4\hat{i} + 2\hat{j} + 3\hat{k}\right)$

C. $0.6\hat{i} + 0.8\hat{j}$

D. $6\hat{i} + 8\hat{j}$

Answer: D

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4. The resultant of two forces , one double the other in magnitude is perpendicular to the smaller of the two forces. The angle between the two forces is _____?

A. 150°

B. 90°

C. 60°

D. 120°

Answer: D

Watch Video Solution

5. If the angle between the unit vectors $\hat{a}$ and $\hat{b}$ is 60°, the $|\hat{a} - \hat{b}|$ is :-

A. 0

B. 1

C. 2

D. 4

Answer: B

Watch Video Solution

6. For a particle moving in a straight line, the displacement of the particle at time t is given by

$S = t^3 - 6t^2 + 3t + 7$

What is the velocity of the particle when its acceleration is zero?

A. $-9ms^{-1}$

B. $-12ms^{-1}$

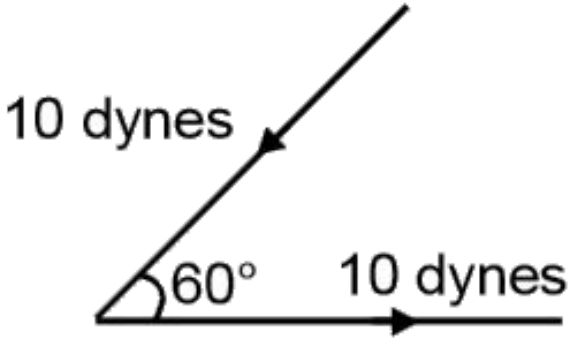
C. $3ms^{-1}$

D. $42ms^{-1}$

Answer: A

Watch Video Solution

7. Two forces each numerically equal to 10 dynes are acting as shown in the following figure, then their resultant is -



A. 10 dynes

B. 20 dynes

C. $10\sqrt{3}$ dynes

D. 5 dynes

Answer: A

Watch Video Solution

8. Two vectors $\vec{A}$ and $\vec{B}$ are such that $\vec{A} + \vec{B} = \vec{A} - \vec{B}$. Then

A. 0

B. $\pi/3$

C. $\pi/2$

D. π

Answer: C

Watch Video Solution

9. A particle moves throught angular displacement θ on a circlur path of radius r. The liner displacement wil be

A. 2r $\sin(\theta/2)$

B. 2r $\cos(\theta/2)$

C. 2r $\tan(\theta/2)$

D. 2r $\cot(\theta/2)$

Answer: A

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10. The vector $\overrightarrow{P}$ makes 120° with the x-axis and vector Q makes 30° with the y-axis. What is their resultant?

A. $P + Q$

B. $P - Q$

C. $\sqrt{P^2 + Q^2}$

D. $\sqrt{P^2 - Q^2}$

Answer: A

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11. A man travels 1 mile due east. Then 5 miles due south, then 2 miles due east and finally 9 miles due north. His displacement is

A. 3 miles

B. 5 miles

C. 4 miles

D. between 5 and 9 miles

Answer: B

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12. If $3\hat{i} + 2\hat{j} + 8\hat{k}$ and $2\hat{i} + x\hat{j} + \hat{k}$ are at right angles then x =

A. 7

B. -7

C. 5

D. -4

Answer: B

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13. $a_1\hat{i} + a_2\hat{j}$ is a unit vector perpendicular to $4\hat{i} - 3\hat{j}$ if -

A. $a_1 = 6, a_2 = 8$

B. $a_1 = 3, a_2 = 4$

C. $a_1 = 8, a_2 = 6$

D. $a_1 = 4, a_2 = 3$

Answer: A

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14. If `vec(a) is a vector and x is a non-zero scalar, then

A. $x\vec{a}$ is a vector in the direction of $\vec{a}$

B. $x\vec{a}$ is a vector collinear to $\vec{a}$

C. $x\vec{a}$ and $\vec{a}$ have independent directions

D. none of these

Answer: B

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15. Two vectors $\vec{A}$ and $\vec{B}$ are defined as $\vec{A} = a\hat{i}$ and $\vec{B} = a\left(\cos\omega\hat{i} + \sin\omega\hat{j}\right)$, were a is a constant and $\omega = \pi/6 rads^{-1}$. If $\left|\vec{A} + \vec{B}\right| = \sqrt{3}\left|\vec{A} - \vec{B}\right|$ at time $t = \tau$ for the first time, the value of τ, in seconds , is _____

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Example

1. Two forces of magnitudes 3N and 4N respectively are acting on a body.

Calculate the resultant force if the angle between them is-

$(i)0^\circ$ $(ii)180^\circ$ $(iii)90^\circ$

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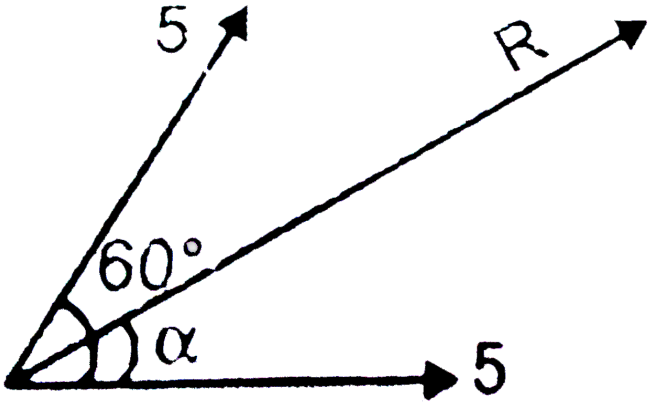
2. Two vectors having equal magnitude of 5 units, have an angle of 60° between them. Find the magnitude of their resultant vector and its angle from one of the vectors.



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3. A vector $\overrightarrow{A}$ and $\overrightarrow{B}$ make angles of 20° and 110° respectively with the X-axis. The magnitudes of these vectors are $5m$ and $12m$ respectively. Find their resultant vector.

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4. If $\vec{P} = 3\hat{i} + 4\hat{j} + 12\hat{k}$ then find

(i) $\left|\vec{P}\right|$ and

(ii) the direction cosines of the $\vec{P}$.

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5. Find out the angle made by $\left(\hat{i} + \hat{j}\right)$ vector from X and Y axes respectively.

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6. Find out the angle made by $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ vector from X, Y and Z axes respectively.

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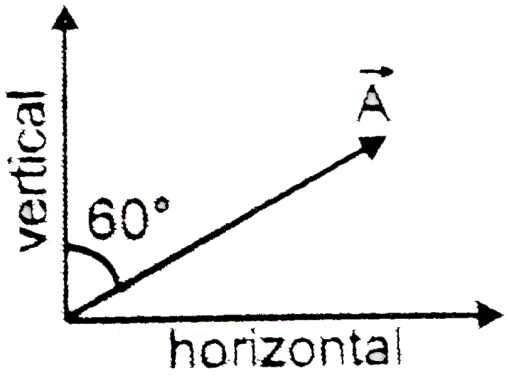
7. A force of 4N is inclined at an angle of 60° from the vertical. Find out its components along horizontal and vertical directions.



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8. A force is inclined at an angle of 60° from the horizontal. If the horizontal component of the force is 40N,calculate the vertical component.

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9. Determine that vector which when added to the resultant of $\vec{P} = 2\hat{i} + 7\hat{j} - 10\hat{k}$ and $\vec{Q} = \hat{i} + 2\hat{j} + 3\hat{k}$ gives a unit vector along X-axis.

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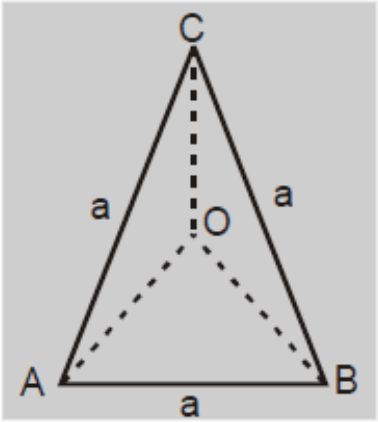
10. ABC is an equilateral triangle. Length of each side is 'a' and centroid is point O.Find

(i) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = ?$

(ii) $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} = ?$

(iii) If $\left|\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{AC}\right| =$ na then n = ?



(iv) If $\overrightarrow{AB} + \overrightarrow{AC} = n\overrightarrow{AO}$ then n = ?

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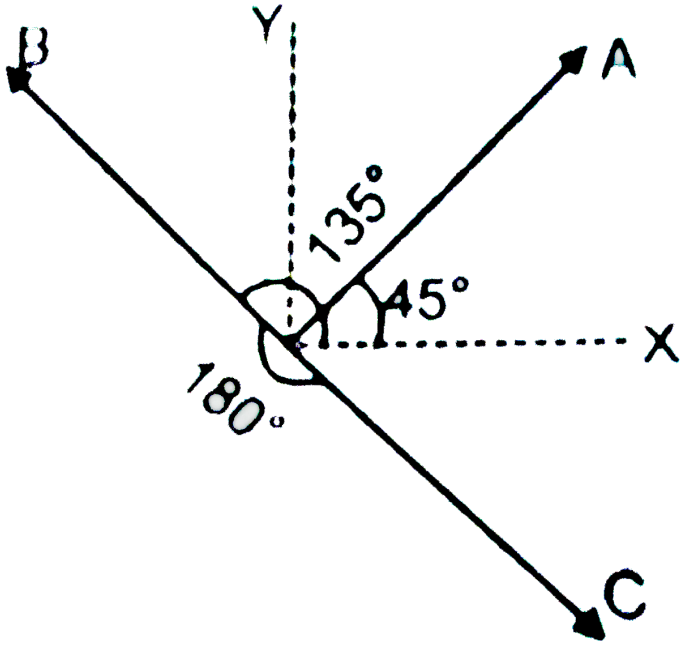
11. Add vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ which have equal magnitude s of 50 unit and are inclined at angles of 45°, 135° and 315° respectively from x-axos.



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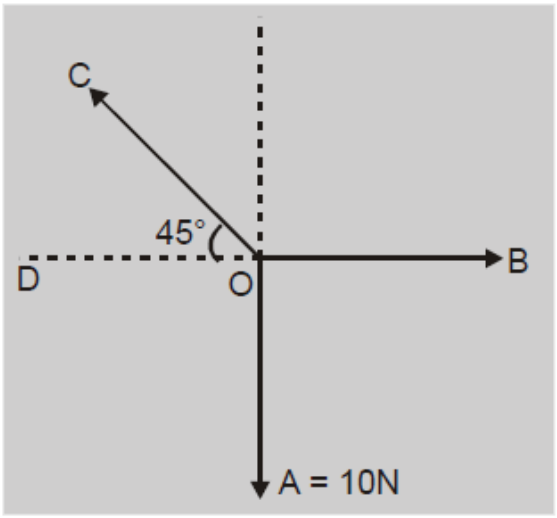
12. The sum of three vectors shown in figure, is zero.

(i) What is the magnitude of vector $\overrightarrow{OB}$?



(ii) What is the magnitude of vector $\overrightarrow{OC}$?

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13. Can scalar product be ever negative ?

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14. If $\left|\vec{A}+\vec{B}\right|=\left|\vec{A}-\vec{B}\right|$, then the angle between $\vec{A}$ and $\vec{B}$ will be

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15. If $\vec{A} = 4\hat{i} + n\hat{j} - 2\hat{k}$ and $\vec{B} = 2\hat{i} + 3\hat{j} + \hat{k}$, then findt the value of n so that $\vec{A} \perp \vec{B}$.

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16. If $\vec{F} = \left(4\vec{i} - 10\vec{j}\right)$ and $\vec{r} = \left(5\vec{i} - 3\vec{j}\right)$, then calculate torque.

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17. Find a unit vector perpendicular to both the vectors $2\hat{i} + 3\hat{j} + \hat{k}\Big)$ and $\left(\hat{i} - \hat{j} + 2\hat{k}\right)$.

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18. The diagonals of a parallelogram are vectors $\vec{A}$ and $\vec{B}$. If $\vec{A} = 5\hat{i} - 4\hat{j} + 3\hat{k}$ and $\vec{B} = 3\hat{i} - 2\hat{j} - \hat{k}$. Calculate the magnitude of

area of this parallelogram.

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19. Given that $P = Q = R$. If $\vec{P} + \vec{Q} = \vec{R}$ then the angle between $\vec{P}$ & $\vec{R}$ is θ_1. If $\vec{P} + \vec{Q} + \vec{R} = \vec{0}$ then the angle between $\vec{P}$ & $\vec{R}$ is θ_2.

What is the relation between θ_1 and θ_2 ?

A. $\theta_1 = \theta_2$

B. $\theta_1 = \frac{\theta_2}{2}$

C. $\theta_1 = 2\theta_2$

D. None of the above

Answer: B

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20. Given that $\vec{A} + \vec{B} + \vec{C} = \vec{0}$. Out of three vectors, two are equal in magnitude and the magnitude of the third vectors is $\sqrt{2}$ times that of either of the two having equal magnitude. Find the angles between the vectors.

A. $30^\circ, 60^\circ, 90^\circ$

B. $45^\circ, 45^\circ, 90^\circ$

C. $45^\circ, 60^\circ, 90^\circ$

D. $90^\circ, 135^\circ, 135^\circ$

Answer: D

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21. The resultant of two vectors $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If the magnitude of $\vec{Q}$ is doudled, the new resultant becomes perpendicuar to $\vec{P}$. Then the magnitude of $\vec{R}$ is :

A. $\left(\frac{P^2 - Q^2}{2PQ}\right)$

B. Q

C. $\frac{P}{Q}$

D. $\frac{P+Q}{P-Q}$

Answer: B

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Exercise 1

1. A force of $6kg$ another of $8kg$ can be applied together to produce the effect of a single force fo

A. 1kg

B. 11kg

C. 15kg

D. 20kg

Answer: B

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2. If the magnitudes of the vectors A, B and C are 6, 8, 10 units respectively and if A + B = C, then the angle between A and C is -

A. $\pi / 2$

B. arc cos (0. 6)

C. arc tan (0.75)

D. $\pi / 4$

Answer: B

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3. The angles between P+Q and P-Q will be

A. 0° only

B. 90° only

C. 180° only

D. between 0° and 180° (both the values inclusive)

Answer: D

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4. What is the resultant of three coplanar forces: 300 N at 0°, 400 N at 30° and 400 N at 150° ?

A. 500 N

B. 700 N

C. 1100 N

D. 300 N

Answer: A

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5. The value of a unit vector in the direction of vector $A = 5\hat{i} - 12\hat{j}$

A. $\hat{i}$

B. $\hat{j}$

C. $\left(\hat{i} + \hat{j}\right)/13$

D. $\left(5\hat{i} - 12\hat{j}\right)/13$

Answer: D

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6. Two forces of 4 dyne and 3 dyne act upon a body. The resultant force on the body can only be –

A. more than 3 dynes

B. more than 4 dynes

C. between 3 and 4 dynes

D. between 1 and 7 dynes

Answer: D

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7. Two vectors have magnitudes 3 unit and 4 unit respectively. What should be the angle between them if the magnitude of the resultant is - (i) 1 unit (ii) 5 unit (iii) 7 unit

A. $180^\circ, 90^\circ, 0^\circ$

B. $80^\circ, 70^\circ, 0^\circ$

C. $80^\circ, 70^\circ, 0^\circ$

D. $90^\circ, 170^\circ, 50^\circ$

Answer: A

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8. A blind person after walking each 10 steps in one direction, each of length 80 cm, turns randomly the left or to right by 90°. After walking a total of 40 steps the maximum possible displacement the person from his starting position could be (A) 320 m (B) 32 m (C) $\frac{16}{\sqrt{2}}$ m (D) $16\sqrt{2}$ m

A. 320 m

B. 32 m

C. $16/\sqrt{2}m$

D. $16\sqrt{2}m$

Answer: D

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9. If the angle between the vectors $\vec{a}$ and $\vec{b}$ is an acute angle, then the diffrence $\vec{a} - \vec{b}$ is

A. the main diagonal of the parallelogram

B. the minor diagonal of the parallelogram

C. any of the above

D. none of the above

Answer: B

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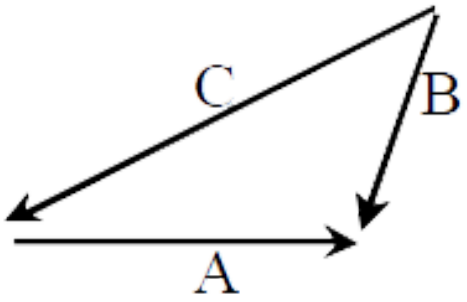
10. For the figure –



A. A + B = C

B. B + C = A

C. C + A = B

D. A + B + C = 0

Answer: C

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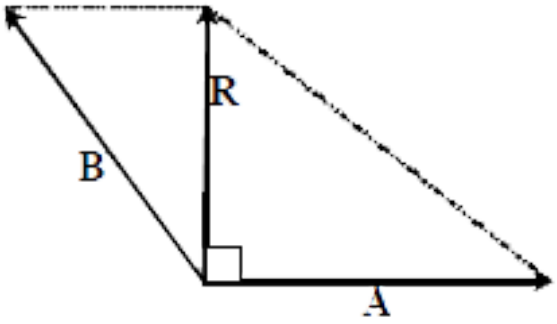
11. The resultant of two vectors A and B is perpendicular to the vector A and its magnitude is equal to half the magnitude of vector B. The angle between A and B is -



A. 120°

B. 150°

C. 135°

D. None of these

Answer: B

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12. Which of the sets given below may represent the magnitudes of three vectors adding to zero?

A. $2, 4, 8$

B. $4, 8, 16$

C. $1, 2, 1$

D. $0.5, 1, 2$

Answer: C

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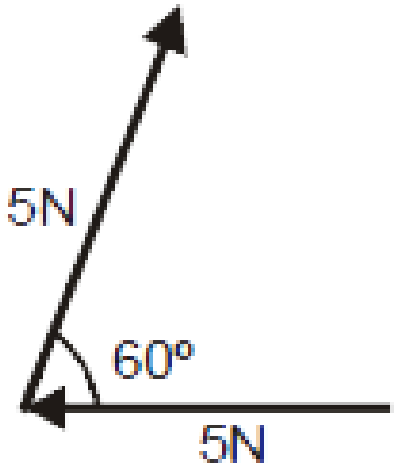
13. The forces, each numerically equal to 5 N, are acting as shown in the Figure. Find the angle between forces?



A. 60

B. 120

C. 30

D. 150

Answer: B

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14. Rain is falling vertically down wards with a speed 5 m/s. If unit vector along upward is defined as $\hat{j}$, represent velocity of rain in vector form.

A. $-5\hat{j}$

B. $5\hat{j}$

C. $5\hat{i}$

D. $-5\hat{i}$

Answer: A

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15. Two forces $\overrightarrow{F}_1$ and $\overrightarrow{F}_2$ are acting at right angles to each other, find their resultant ?

A. $\sqrt{F_1^2 + F_2^2}$

B. $\sqrt{F_1^2 - F_2^2}$

C. $F_1 + F_2$

D. $F_1 - F_2$

Answer: A

Watch Video Solution

16. Two forces F_1 and F_2 are acting on a body. One force is double that of the other force and the resultant is equal to the greater force. Then the angle between the two forces is

A. $\cos^{-1}(1/2)$

B. $\cos^{-1}(-1/2)$

C. $\cos^{-1}(-1/4)$

D. $\cos^{-1}(1/4)$

Answer: C

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17. Two forces $\overrightarrow{F}_1 = 500N$ due east and $\overrightarrow{F}_2 = 250N$ due north have their common initial point. $\overrightarrow{F}_2 - \overrightarrow{F}_1$ is

A. $250\sqrt{5}N$

B. 250 N

C. 625 N

D. 750 N

Answer: A

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18. The vector sum of the forces of 10 newton and 6 newton can be:

A. 2N

B. 8N

C. 18N

D. 20N

Answer: B

Watch Video Solution

19. The vector sum of two force P and Q is minimum when the angle θ between their positive directions , is

A. $\frac{\pi}{3}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. π

Answer: D

Watch Video Solution

20. The vector sum of two vectors $\vec{A}$ and $\vec{B}$ is maximum , then the angle θ between two vector is

A. 0°

B. 30°

C. 45°

D. 60°

Answer: A

Watch Video Solution

21. if $\vec{P} + \vec{Q} = \vec{P} - \vec{Q}$, then

A. $\theta = 0^\circ$

B. $\theta = 90^\circ$

C. P = 0

D. Q = 0

Answer: B

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22. The sum and difference of two perpendicular vectors of equal length are ...

A. of equal lengths and have an acute angle between them

B. of equal lengths and have an obtuse angle between them

C. also perpendicular to each other and are of different lengths

D. also perpendicular to each other and are of equal lengths

Answer: D

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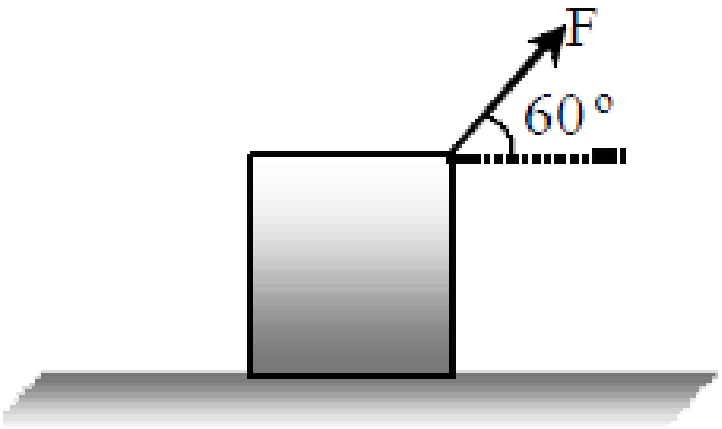
23. A child pulls a box with a force of 200 N at an angle of 60° above the horizontal. Then the horizontal and vertical components of the force are-



A. 173.2 N, 175 N

B. 86.6 N, 100 N

C. 100 N, 86.6 N

D. 100 N, 0 N

Answer: A

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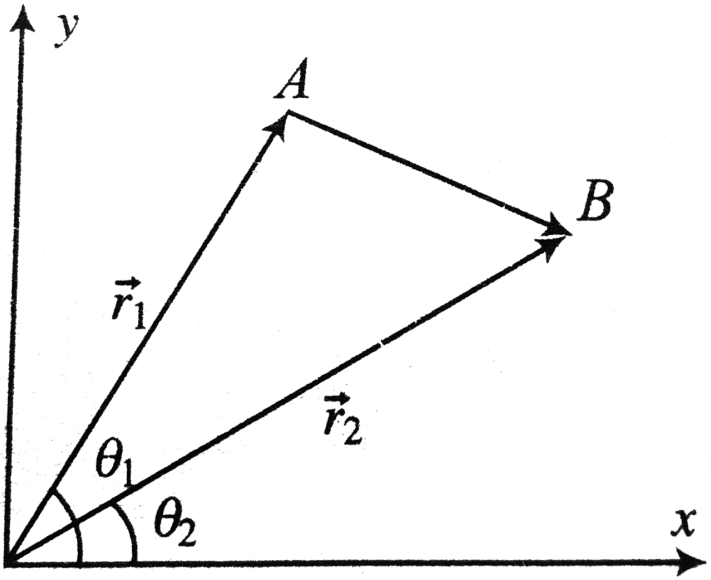
24. In a two dimensional motion of a particle, the particle moves from point A, with position vector $\vec{r}_1$ to point B, with position vector $\vec{r}_2$. If

the magnitudes of these vectors are, respectively, $r_1 = 3$ and $r_2 = 4$ and the angles they make with the x-axis are $\theta_1 = 75^\circ$ and $\theta_2 = 15^\circ$, respectively, then find the magnitude of the displacement vector.



A. $\sqrt{3}$

B. $\sqrt{13}$

C. $\sqrt{5}$

D. $\sqrt{1}$

Answer: B

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25. Two vectors A and B lie in X-Y plane. The vector B is perpendicular to vector A. If $A = \hat{i} + \hat{j}$, then B may be -

A. $\hat{i} - \hat{j}$

B. $-\hat{i} + \hat{j}$

C. $-2\hat{i} + 2\hat{j}$

D. Any of the above

Answer: D

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26. Two constant forces $F_1 = 2\hat{i} - 3\hat{j} + 3\hat{k}(N)$ and $F_2 = \hat{i} + \hat{j} - 2\hat{k}(N)$ act on a body and displace it from the position $r_1 = \hat{i} + 2\hat{j} - 2\hat{k}(m)$ to the position $r_2 = 7\hat{i} + 10\hat{j} + 5\hat{k}(m)$. What is the work done

A. 9 Joule

B. 41 Joule

C. –3 Joule

D. None of these

Answer: A

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27. The two vectors $A = 2\hat{i} + \hat{j} + 3\hat{k}$ and $B = 7\hat{i} - 5\hat{j} - 3\hat{k}$ are -

A. parallel

B. perpendicular

C. anti-parallel

D. none of these

Answer: B

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28. The angle made by the vector $\vec{A} = 2\hat{i} + 3\hat{j}$ with Y-axis is

A. $\tan^{-1} 3/2$

B. $\tan^{-1} 2/3$

C. $\sin^{-1} 2/3$

D. $\cos^{-1} 3/2$

Answer: B

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29. A vector perpendicular to $\left(4\hat{i} + 3\hat{j}\right)$ is -

A. $4\hat{i} - 3\hat{j}$

B. $7\hat{k}$

C. $6\hat{i}$

D. $3\hat{i} - 4\hat{j}$

Answer: C

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30. The vectors $P = 2\hat{i} + b\hat{j} + 2\hat{k}$ and $Q = \hat{i} + \hat{j} + \hat{k}$ will be perpendicular if -

A. b = 0

B. b = 1

C. b = 2

D. b = -4

Answer: D

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31. A vector $\overrightarrow{A}$ points vertically upward and $\overrightarrow{B}$ points towards north. The vector produce $\overrightarrow{A} \times \overrightarrow{B}$ is

A. along west

B. along east

C. zero

D. vertically downward

Answer: A

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32. The linear velocity of a rotating body is given by $v = \omega \times r$, where ω is the angular velocity and r is the radius vector. The angular velocity of a body $\omega = \hat{i} - 2\hat{j} + 2\hat{k}$ and their radius vector $r = 4\hat{j} - 3\hat{k}$, $|v|$ is -

A. $\sqrt{29}$ units

B. 31 units

C. $\sqrt{37}$ units

D. $\sqrt{41}$ units

Answer: A

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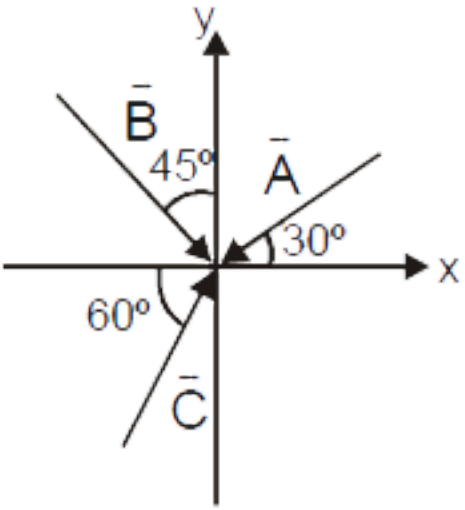
33. Vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are shown in figure. Find angle between



$(i)\vec{A}$ and $\vec{B}$ $(ii)\vec{A}$ and $\vec{C}$ $(iii)\vec{B}$ and $\vec{C}$.

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34. The magnitude of scalar product of two vectors is 8 and of vector product is $8\sqrt{3}$. The angle between them is:

A. 30°

B. 60°

C. 120°

D. 150°

Answer: B

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35. Which of the following sets of displacements might be capable of bringing a car to its returning point ?

A. 5, 10, 30 and 50 km

B. 5, 9, 9 and 16 km

C. 40, 40, 90 and 200 km

D. 10, 20, 40 and 90 km

Answer: B

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36. Match the statements given in column-I with statements given in column-II

Column - I	Column - II
(A) If $\left\|\vec{A}\right\| = \left\|\vec{B}\right\|$ and $\left\|\vec{A}\right\|$ then angle between $\vec{A}$ and $\vec{B}$ is	$(p) 90^\circ$
(B) Magnitude of resultant of two forces $\left\|\vec{F}_1\right\| = 8N$ and $\left\|\vec{F}_2\right\| = 4N$ may be	$(q) 120^\circ$
(C) Angle between $\vec{A} = 2\hat{i} + 2\hat{j} \& \vec{B} = 3\hat{k}$ is	$(r) 12N$
(D) Magnitude of resultant of vectors $\vec{A} = 2\hat{i} + \hat{j} \& \vec{B} = 3\hat{k}$ is	$(s) \sqrt{14}$

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Exercise 2

1. A vector is not changed if -

A. It is rotated through an arbitrary angle

B. It is multiplied by an arbitrary scale

C. It is cross multiplied by a unit vector

D. It is a slide parallel to itself

Answer: D

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2. If the resultant of two forces of magnitudes P and Q acting at a point at an angle of 60° is $\sqrt{7}Q$, then P/Q is

A. 1

B. $3/2$

C. 2

D. 4

Answer: C

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3. The resultant of $\vec{A}$ and $\vec{B}$ makes an angle α with $\vec{A}$ and $\vec{\beta}$ with $\vec{B}$, then -

A. $\alpha < \beta$

B. $\alpha < \beta$ if $A < B$

C. $\alpha < \beta$ if $A > B$

D. $\alpha < \beta$ if $A = B$

Answer: C

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4. A person moves 30 m north. Then 30 m east, then $30\sqrt{2}$ m south-west. His displacement from the original position is

A. 14 m south-west

B. 28 m south

C. 10 m west

D. 15 m East

Answer: C

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5. A man moves towards 3m north then 4 m towards east and finally 5 m towards 37° south of west. His displacement from origin is :-

A. $5\sqrt{2}$ m

B. 0 m

C. 1 m

D. 12 m

Answer: B

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6. I started walking down a road to day-break facing the sun. After walking for some-time, I turned to my left, then I turned to the right once again. In which direction was I going then ?

A. East

B. North-west

C. North-east

D. South

Answer: A

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7. How many minimum number of vectors in different planes can be added to give zero resultant ?

A. 2

B. 3

C. 4

D. 5

Answer: C

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8. What are minmum number or unequal fores whose vector sum is zero ?

A. two

B. three

C. four

D. any

Answer: B

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9. If $\left|\vec{A}-\vec{B}\right|=\left|\vec{A}\right|=\left|\vec{B}\right|$, the angle between $\vec{A}$ and $\vec{B}$ is

A. 60°

B. 0°

C. 120°

D. 90°

Answer: C

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10. Two vectors $\vec{A}$ and $\vec{B}$ are such that $\vec{A}+\vec{B}=\vec{A}-\vec{B}$. Then

A. $\vec{A}+\vec{B}=0$

B. $\vec{A}-\vec{B}=0$

C. $\vec{A}=0$

D. $\overrightarrow{B} = 0$

Answer: D

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11. Find the vector sum of N coplanar forces, each of the magnitude F ,when each force makes an angle of $2\pi / N$ with that preceding it.

A. F

B. NF

C. $\frac{NF}{2}$

D. Zero

Answer: D

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12. Three forces P,Q and R are acting at a point in the plane. The angle between P & Q and Q & R are $150^\circ \& 120^\circ$ respectively, then for equilibrium, forces P,Q & R are in the ratio

A. $1:2:3$

B. $1:2:\sqrt{3}$

C. $3:2:1$

D. $\sqrt{3}:2:1$

Answer: D

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13. Two forces, each of magnitude F have a resultant of the same magnitude F. The angle between the two forces is

A. 45°

B. 120°

C. 150°

D. 60°

Answer: B

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14. The resultant of two forces, one double the other in magnitude is perpendicular to the smaller of the two forces. The angle between the two forces is

A. 150°

B. 90°

C. 60°

D. 120°

Answer: D

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15. A particle is moving on a circular path with constant speed v then the change in its velocity after it has desceibed an angle of 60° will be

A. $v\sqrt{2}$

B. $v\sqrt{3}$

C. v

D. 2 v

Answer: C

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16. A man moves towards 3m north then 4 m towards east and finally 5 m towards 37° south of west. His displacement from origin is :-

A. $5\sqrt{2}$ m

B. 0 m

C. 1 m

D. 12 m

Answer: B

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17. A particle is acted upon by the forces $\vec{F}_1 = 2\hat{i} + a\hat{j} - 3\hat{k}, \vec{F}_2 = 5\hat{i} + c\hat{j} - b\hat{k}, \vec{F}_3 = b\hat{i} + 5\hat{j} - 7\hat{k}, \vec{F}_4 = c\hat{i} +$. Find the values of the constants a, b, c in order that the particle will be in equilibrium.

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18. A vector $\vec{A}$ of length 10 units makes an angle of 60° with a vector $\vec{B}$ of length 6 units. Find the magnitude of the vector difference $\vec{A} - \vec{B}$ & the angles with vector $\vec{A}$.

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19. The component of a vector is

A. always less than its magnitude

B. always greater than its magnitude

C. always equal to its magnitude

D. none of these

Answer: D

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20. The magnitude of the vector product of two vectors $\vec{A}$ and $\vec{B}$ may be -

(a) Greater than AB (b) Equal to AB

(c) Less than AB (d) Equal to Zero

A. a, b, c

B. b, c, d

C. a, c, d

D. a, b, d

Answer: B

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21. Three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ satisfy the relation $\vec{A} . \vec{B} = 0$ and $\vec{A} . \vec{C} = 0$. The vector $\vec{A}$ is parallel to

A. $\vec{B}$

B. $\vec{C}$

C. $\vec{B} . \vec{C}$

D. $\vec{B} \times \vec{C}$

Answer: D

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22. The angle between the two vectors

$-2\hat{i}+3\hat{j}+\hat{k}$ and $\hat{i}+2\hat{j}-4\hat{k}$ is -

A. 0°

B. 90°

C. 180°

D. None

Answer: B

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23. A body constrained to move in y direction is subjected to a force given by $\overrightarrow{F}=\left(-2\hat{i}+15\hat{j}+6\hat{k}\right)$ N . What is the work done by this force in moving the body through a distance of $10m$ along y-axis ?

A. 190 J

B. 160 J

C. 150 J

D. 20 J

Answer: C

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24. If the angle between the unit vectors $\hat{a}$ and $\hat{b}$ is 60°, the $\left|\hat{a} - \hat{b}\right|$ is :-

A. 0

B. 1

C. 2

D. 4

Answer: B

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25. A vector $\vec{A}$ points vertically upward and $\vec{B}$ points towards north. The vector produce $\vec{A} \times \vec{B}$ is

A. along west

B. along east

C. zero

D. vertically downward

Answer: A

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26. What is the angle between $\left(\vec{P} + \vec{Q}\right)$ and $\left(\vec{P} \times \vec{Q}\right)$

A. 0

B. $\frac{\pi}{2}$

C. $\frac{\pi}{4}$

D. π

Answer: B

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27. Which of the following is not true ? If $\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = 6\hat{i} + 8\hat{j}$ where A and B are the magnitudes of $\vec{A}$ and $\vec{B}$?

A. $\vec{A} \times \vec{B} = 0$

B. $\frac{A}{B} = \frac{1}{2}$

C. $\vec{A} . \vec{B} = 48$

D. $A = 5$

Answer: C

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28. For the any two vecrtors $\vec{A}$ and $\vec{B}$, if $\vec{A} . \vec{B} = \left|\vec{A} \times \vec{B}\right|$, the magnitude of $\vec{C} = \vec{A} + \vec{B}$ is equal to

A. $\sqrt{A^2+B^2}$

B. $A+B$

C. $\sqrt{A^2+B^2+\frac{AB}{\sqrt{2}}}$

D. $\sqrt{A^2+B^2+\sqrt{2}AB}$

Answer: D

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29. If vector $\vec{A}=\hat{i}+2\hat{j}+4\hat{k}$ and $\vec{B}=5\hat{i}$ represent the two sides of a triangle, then the third side of the triangle can have length equal to

A. $\sqrt{56}$

B. $\sqrt{21}$

C. 5

D. 6

Answer: A

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30. A vector $\overrightarrow{F}_1$ is along the positive X-axis. If its vectors product with another vector $\overrightarrow{F}_2$ is zero then $\overrightarrow{F}_2$ could be

A. $4\hat{j}$

B. $-\left(\hat{i}+\hat{j}\right)$

C. $\left(\hat{j}+\hat{k}\right)$

D. $\left(-4\hat{i}\right)$

Answer: D

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31. The unit vector along vector $\hat{i}+\hat{j}+\hat{k}$ is .....

A. $\sqrt{3}$

B. $\sqrt{2}$

C. 1

D. 0

Answer: C

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32. When two forces of magnitude P and Q are perpendicular to each other, their resultant is of magnitude R. When they are at an angle of 180° to each other their resultant is of magnitude $\frac{R}{\sqrt{2}}$. Find the ratio of P and Q.

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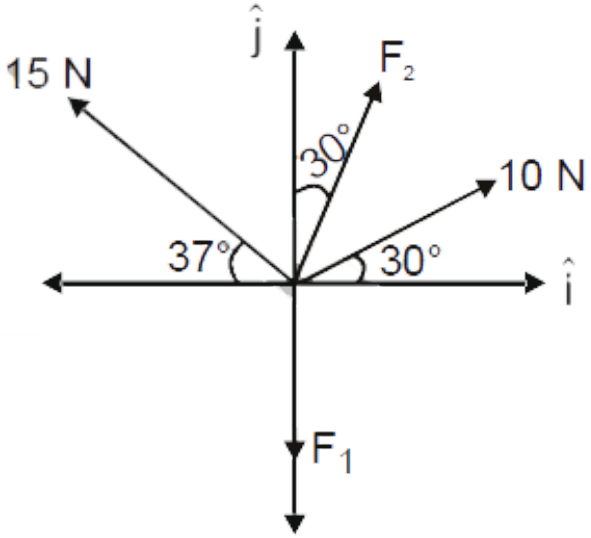
33. If the four forces as shown are in equilibrium Express $\vec{F}_1 \& \vec{F}_2$ in unit vector form.



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Exercise 3

1. If a vector $\left(2\hat{i}+3\hat{j}+8\hat{k}\right)$ is perpendicular to the vector $\left(4\hat{j}-4\hat{i}+\alpha\hat{k}\right)$, then the value of α is :

A. -1

B. $1/2$

C. $-1/2$

D. 1

Answer: C

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2. If the angle between the vectors $\vec{A}$ and $\vec{B}$ is θ, the value of the product $\left(\vec{B} \times \vec{A}\right) \cdot \vec{A}$ is equal to

A. $BA^2 \cos\theta$

B. $BA^2 \sin\theta$

C. $BA^2 \sin\theta \cos\theta$

D. zero

Answer: D

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3. If $\left|\vec{A} \times \vec{B}\right| = \sqrt{3}\vec{A} \cdot \vec{B}$, then the value of $\left|\vec{A} + \vec{B}\right|$ is

A. $\left(A^2 + B^2 + AB\right)^{1/2}$

B. $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$

C. $A + B$

D. $\left(A^2 + B^2 + \sqrt{3}AB\right)^{1/2}$

Answer: A

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4. Square of the resultant of two forces of equal magnitude is equal to three times the product of their magnitude. The angle between them is

A. 0°

B. 45°

C. 60°

D. 90°

Answer: C

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5. A particle moves with a velocity $v = \left(5\hat{i} - 3\hat{j} + 6\hat{k}\right) ms^{-1}$ under the influence of a constant force $F = \left(10\hat{i} + 10\hat{j} + 20\hat{h}\right) N$, the instantaneous power applied to the particle is.

A. $200 Js^{-1}$

B. $40 Js^{-1}$

C. $140 Js^{-1}$

D. $170 Js^{-1}$

Answer: C

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6. A river is flowing from west to east with a speed of $5m/\min$. A man can swim in still water with a velocity $10m/\min$. In which direction should the man swim so as to take the shortest possible path to go to the south.

A. 30° east of south

B. 60° east of south

C. 60° west of south

D. 30° east of north

Answer: A

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7. The vectors for origin to the points A and B are $A = 3\hat{i} - 6\hat{j} + 2\hat{k}$ and $B = 2\hat{i} + \hat{j} - 2\hat{k}$, respectively. The area of the ΔOAB is

A. $\frac{5}{2}\sqrt{17}$

B. $\frac{2}{5}\sqrt{17}$

C. $\frac{3}{5}\sqrt{17}$

D. $\frac{5}{3}\sqrt{17}$

Answer: A

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8. Minimum number of vectors of unequal magnitudes which can give zero resultant are

A. two

B. three

C. four

D. more than four

Answer: A

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9. A police jeep is chasing with, velocity of $45km/h$ a thief in another jeep moving with velocity $153km/h$. Police fires a bullet with muzzle velocity of $180m/s$. The velocity it will strike the car of the thief is.

A. $150ms^{-1}$

B. $27ms^{-1}$

C. $450ms^{-1}$

D. $250ms^{-1}$

Answer: A

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10. The vector $\vec{A}$ and $\vec{B}$ are such that $\left|\vec{A}+\vec{B}\right| = \left|\vec{A}-\vec{B}\right|$. The angle between vectors $\vec{A}$ and $\vec{B}$ is -

A. 90°

B. 60°

C. 75°

D. 45°

Answer: A

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11. $\vec{A}$ and $\vec{B}$ are two vectors and θ is the angle between them, if $\left|\vec{A} \times \vec{B}\right| = \sqrt{3}\left(\vec{A} . \vec{B}\right)$ the value of θ is:-

A. 90°

B. 60°

C. 45°

D. 30°

Answer: B

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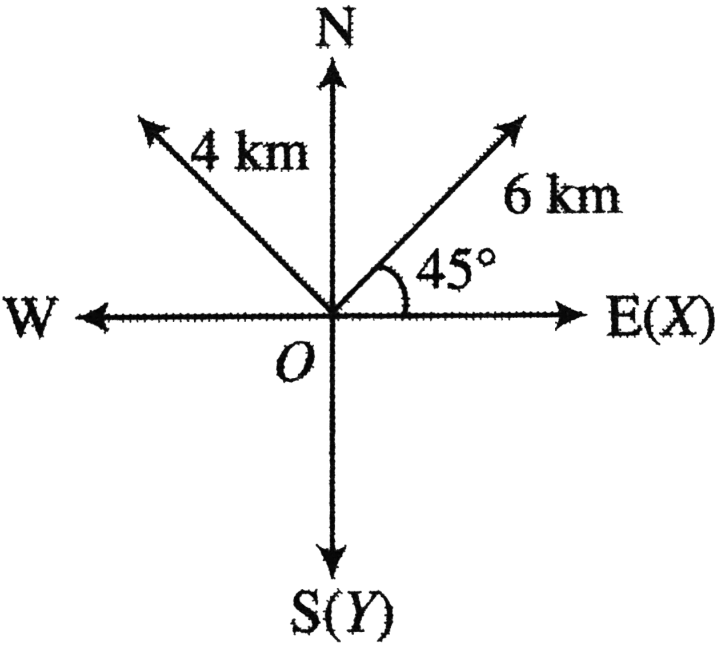
12. A car travles 6km towards north at an angle of 45° to the east and then travles distance of 4km towards north at an angle of 135° to east (figure). How far is the point from the starting point? What angle does the straight line joining its initial and final position makes with the east?



A. $\sqrt{50}km$ and $\tan^{-1}(5)$

B. $\sqrt{10}km$ and $\tan^{-1}(\sqrt{5})$

C. $\sqrt{52}km$ and $\tan^{-1}(5)$

D. $\sqrt{52}km$ and $\tan^{-1}(\sqrt{5})$

Answer: C

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13. Two forces of $12N$ and $8N$ act upon a body. The resultant force on the body maximum value of

A. 4 N

B. zero

C. 20 N

D. 8 N

Answer: C

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14. A proton in a cyclotron changes its velocity from 30 kmh^{-1} the north of 45 kmh^{-1} the east in 20 s. What is the magnitude of average acceleration during this time ?

A. $2.5kms^{-2}$

B. $12.5kms^{-2}$

C. $22.5kms^{-2}$

D. $32.5kms^{-2}$

Answer: A

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15. Rain is falling vertically downwards with a speed of $4kmh^{-1}$. A girl moves on a straight road with a velocity of $3kmh^{-1}$. The apparent velocity of rain with respect to the girl is.

A. $1kmh^{-1}$

B. $3kmh^{-1}$

C. $4kmh^{-1}$

D. $5kmh^{-1}$

Answer: D

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16. A train of $150m$ length is going toward north direction at a speed of $10ms^{-1}$. A parrot flies at a speed of $5ms^{-1}$ toward south direction parallel to the railway track. The time taken by the parrot to cross the train is equal to.

A. 12 s

B. 8 s

C. 15 s

D. 10 s

Answer: D

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17. Three are N coplancar vectors each of magnitude V Each vector is inclined to the preceding vector atangle $\frac{2\pi}{N}$ What is the magnitude of their resultant ?

A. $\frac{V}{N}$

B. V

C. Zero

D. $\frac{N}{V}$

Answer: C

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18. A particle is moving such that its position coordinates (x, y) are $(2m, 3m)$ at time $t = 0$, $(6m, 7m)$ at time $t = 2s$, and $(13m, 14m)$ at time $t = 5s$.

Average velocity vector $\left(\vec{V}_{av}\right)$ from $t = 0$ to $t = 5s$ is

A. $\frac{1}{5}\left(13\hat{i} + 14\hat{j}\right)$

B. $\frac{7}{3}\left(\hat{i} + \hat{j}\right)$

C. $2\left(\hat{i} - \hat{j}\right)$

D. $\frac{11}{5}\left(\hat{i} + \hat{j}\right)$

Answer: D

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