NEET UG (2024)
Physics
Quiz-13

1. cos 2A is equal to

(1) $1 - 2\sin^2 A$ (2) $2\cos^2 A - 1$

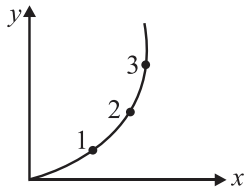
(3) $\cos^2 A - \sin^2 A$ (4) All

2. $\sin(90° - \theta)$ is equal to:

(1) $\sin\theta$ (2) $-\sin\theta$

(3) $\cos\theta$ (4) $-\cos\theta$

3. The slope of graph as shown in figure at point 1, 2 and 3 is m_1, m_2 and m_3 respectively then



(1) $m_1 > m_2 > m_3$ (2) $m_1 < m_2 < m_3$

(3) $m_1 = m_2 = m_3$ (4) $m_1 = m_2 > m_3$

4. Given $x^2 + 7x + 12 = 0$, find the root of x

(1) $x = \frac{3}{2}, -4$ (2) $x = -3, -4$

(3) $x = \frac{3}{2}, 4$ (4) $x = \frac{3}{2}, -2$

5. $(1 + x)^3$ find the value, if $x << 1$.

(1) $1 + x$ (2) $1 - 3x$

(3) $1 + 3x$ (4) $1 + 3x + 3x^2 + x^3$

6. If $y = e^{-\alpha x}$, then find double differentiation of y.

(1) $\alpha e^{-\alpha x}$ (2) $-\alpha e^{-\alpha x}$

(3) $e^{-\alpha x}$ (4) $\alpha^2 e^{-\alpha x}$

7. Find the value of cos (330°)

(1) sin 45°

(2) –cos 30°

(3) cos 60°

(4) sin 60°

8. If $\tan\theta = 1/\sqrt{5}$ and θ lies in the first quadrant, the value of $\cos\theta$ is:

(1) $\sqrt{\frac{5}{6}}$ (2) $-\sqrt{\frac{5}{6}}$

(3) $\frac{1}{\sqrt{6}}$ (4) $-\frac{1}{\sqrt{6}}$

9. The sum of the series $1 + 1/4 + 1/16 + 1/64 + \cdots \infty$ is

(1) 8/7 (2) 6/5

(3) 5/4 (4) 4/3

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

(1) 2 N (2) 8 N

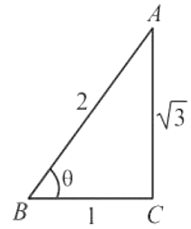
(3) 18 N (4) 20 N

11. Distance between points (2, 3, –7) and (–2, 0, 5) is

(1) 5 (2) 13

(3) $\sqrt{145}$ (4) $\sqrt{119}$

12. Find the angle $\angle ABC$



(1) 0°

(2) 60°

(3) 30°

(4) 45°

13. Find the value of sin 15°.

(1) $\frac{\sqrt{3}-1}{\sqrt{2}}$

(2) $\frac{\sqrt{3}-\sqrt{2}}{2\sqrt{2}}$

(3) $\frac{\sqrt{3}-1}{2\sqrt{2}}$

(4) $\frac{1}{2}$

14. Convert angle from radian to degree $\frac{\pi}{3}$ rad:

(1) 60° (2) 30°

(3) 45° (4) 0°

15. Convert angle from radian to degree $\frac{4\pi}{3}$ rad:

(1) 120° (2) 240°

(3) 150° (4) 0°

16. If $\frac{\cos\theta+\sin\theta}{\sin\theta-\cos\theta}=\frac{5}{3}$ then find value tan θ

(1) $\frac{3}{5}$ (2) $\frac{1}{4}$

(3) $\frac{3}{2}$ (4) $\frac{8}{2}$

17. Find sum of infinite term

$1-\frac{1}{2}+\frac{1}{4}-\frac{1}{8}+\frac{1}{16}-\frac{1}{32}.....\infty$

(1) $\frac{1}{2}$ (2) $\frac{2}{3}$

(3) 2 (4) $\frac{3}{2}$

18. Find the value of $\log_{10}10^{35}$

(1) 28 (2) 32

(3) 36 (4) 35

19. $\log_2(x) = -5$, find the value of x

(1) $\frac{1}{15}$ (2) $\frac{1}{35}$

(3) $\frac{1}{45}$ (4) $\frac{1}{32}$

20. What is the value of $\log_2 16$?

(1) 8 (2) 4

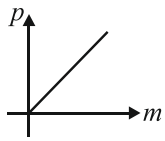
(3) 1/8 (4) 16

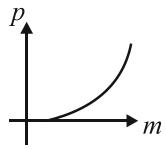
21. The slope of straight line $\sqrt{3}y=3x+4$ is

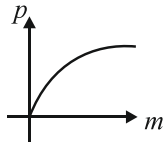
(1) 3 (2) $\sqrt{3}$

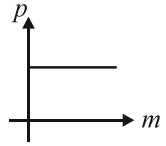
(3) $\frac{1}{\sqrt{3}}$ (4) $\frac{1}{3}$

22. Draw graph between momentum and mass of the object for constant K $\left[P=\sqrt{2mE}=mv\right]$

(1) 

(2) 

(3) 

(4) 

23. Find $\frac{dv}{dt}$ at $t = 2$, if $v = 2t^2 + 4t$

(1) 4 (2) 8

(3) 12 (4) 16

24. If $y = x^2 - 10x$. Find the minimum value of y.

(1) –8 (2) 16

(3) 14 (4) –25

25. The expression $\left(\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}\right)$ is a

(1) Unit vector

(2) Null vector

(3) Vector of magnitude $\sqrt{2}$

(4) Scalar

26. $\int_0^1 (x^3+1)\,dx$

(1) $\frac{1}{4}$ (2) $\frac{3}{4}$

(3) $\frac{5}{4}$ (4) $\frac{7}{4}$

27. $\int e^{5x}dx$

(1) $e^{5x}+C$

(2) $e^{5x}\cdot\frac{5x^2}{2}+C$

(3) $\frac{e^{5x}}{5}+C$

(4) $e^{x}+C$

28. The vectors $5\hat{i}+8\hat{j}$ and $2\hat{i}+7\hat{j}$ are added. The magnitude of the sum of these vector is

(1) $\sqrt{274}$

(2) 38

(3) 238

(4) 560

29. For the resultant of the two vectors to be maximum, what must be the angle between them

(1) 0° (2) 60°

(3) 90° (4) 180°

30. Identify the vector quantity among the following:

(1) Distance

(2) Angular momentum

(3) Heat

(4) Energy

31. The angles which a vector $\hat{i}+\hat{j}+\sqrt{2}\hat{k}$ make with X, Y and Z axes respectively are

(1) 60°, 60° 60° (2) 45°, 45°, 45°

(3) 60°, 60°, 45° (4) 45°, 45°, 60°

32. If two vectors $2\hat{i}+3\hat{j}-\hat{k}$ and $-4\hat{i}-6\hat{j}-\lambda\hat{k}$ are parallel to each other, then value of λ will be

(1) 0 (2) –2

(3) 3 (4) 4

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

(1) 0 (2) π/3

(3) π/2 (4) π/4

34. A physical quantity which has a direction:
(1) Must be a vector
(2) May be a vector
(3) Must be a scalar
(4) None of the above

35. Two forces of magnitudes F and $\sqrt{3}F$ act at right angle to each other. Their resultant makes an angle β with F. The value of β is
(1) 30° (2) 45°
(3) 60° (4) 135°

SECTION-B

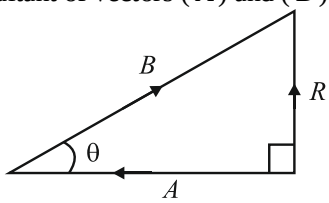
36. Given: $\vec{A} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{B} = -\hat{i} - \hat{j} + \hat{k}$. The unit vector of $\vec{A} - \vec{B}$ is
(1) $\frac{3\hat{i} + \hat{k}}{\sqrt{10}}$ (2) $\frac{3\hat{i}}{\sqrt{10}}$
(3) $\frac{\hat{k}}{\sqrt{10}}$ (4) $\frac{-3\hat{i} - \hat{k}}{\sqrt{10}}$

37. Which of the following is correct for $(64)^{2/3}$
(1) 16 (2) 32
(3) 4 (4) 8

38. Which of the following sets of concurrent forces may be in equilibrium?
(1) F_1 = 3 N, F_2 = 5 N, F_3 = 1 N
(2) F_1 = 3 N, F_2 = 5 N, F_3 = 9 N
(3) F_1 = 3 N, F_2 = 5 N, F_3 = 6 N
(4) F_1 = 3 N, F_2 = 5 N, F_3 = 15 N

39. The angle that the vector $\vec{A} = 2\hat{i} + 3\hat{j}$ makes with y-axis is:
(1) $\tan^{-1}(3/2)$ (2) $\tan^{-1}(2/3)$
(3) $\sin^{-1}(2/3)$ (4) $\cos^{-1}(3/2)$

40. In vector diagram shown in figure where ($\vec{R}$) is the resultant of vectors ($\vec{A}$) and ($\vec{B}$).



If $R = \frac{B}{\sqrt{2}}$, then value of angle θ is:
(1) 30° (2) 45°
(3) 60° (4) 75°

41. If $A = 3\hat{i} + 4\hat{j}$ and $B = 7\hat{i} + 24\hat{j}$, the vector having the same magnitude as B and parallel to A is
(1) $5\hat{i} + 20\hat{j}$ (2) $15\hat{i} + 10\hat{j}$
(3) $20\hat{i} + 15\hat{j}$ (4) $15\hat{i} + 20\hat{j}$

42. $\frac{d}{dx}(\sin 30°)$ is equal to
(1) cos 30°
(2) cosec 30°
(3) 0
(4) sin 30°

43. The angle made by the vector $\vec{A} = \hat{i} + \hat{j}$ with x-axis is
(1) 90° (2) 45°
(3) 22.5° (4) 30°

44. Angular momentum is
(1) A scalar
(2) A polar vector
(3) An axial vector
(4) None of these

45. If $\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ then direction cosines of the vector $\vec{A}$ are
(1) $\frac{2}{\sqrt{45}}, \frac{4}{\sqrt{45}}$ and $\frac{-5}{\sqrt{45}}$
(2) $\frac{1}{\sqrt{45}}, \frac{2}{\sqrt{45}}$ and $\frac{3}{\sqrt{45}}$
(3) $\frac{4}{\sqrt{45}}$, 0 and $\frac{4}{\sqrt{45}}$
(4) $\frac{3}{\sqrt{45}}, \frac{2}{\sqrt{45}}$ and $\frac{5}{\sqrt{45}}$

46. $\frac{d}{d\theta}\sin\theta = ?$
(1) cos θ
(2) – sin θ
(3) – cos θ
(4) None

47. A force vector applied on a mass is represented as $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$ and the mass accelerates with 1 m / s^2. What will be the mass of the body?
(1) $10\sqrt{2}$ kg
(2) $2\sqrt{10}$ kg
(3) 10 kg
(4) 20 kg

48. If a unit vector is represented by $0.5\hat{i} + 0.8\hat{j} + c\hat{k}$, then the value of ' c ' is:
(1) 1
(2) $\sqrt{0.11}$
(3) $\sqrt{0.01}$
(4) $\sqrt{0.39}$

49. The magnitude of the sum of the two vectors is equal to the difference of their magnitudes. What is the angle between the vectors?

(1) 0° (2) 4.5°
(3) 90° (4) 180°

50. The sum of the magnitudes of two vectors is 18 and the magnitude of their resultant is 12. If the resultant is perpendicular to one of the vectors, then what are the magnitudes of the two vectors?

(1) 5, 13 (2) 6, 12
(3) 7, 11 (4) 8, 11

Solution

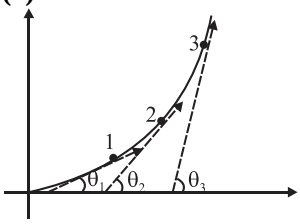
1. **(4)**

$\cos 2A = \cos^2 A - \sin^2 A$
$= 1 - 2\sin^2 A$
$= 2\cos^2 A - 1$

2. **(3)**

$\sin(90 - \theta) = +\cos\theta$

3. **(2)**



$\theta_3 > \theta_2 > \theta_1$
$m_3 > m_2 > m_1$

4. **(2)**

$x^2 + 7x + 12 = 0$
$(x + 3)(x + 4) = 0$
$x = -3, -4$

5. **(3)**

$(1 + x)^3 = 1 + 3x + 3x^2 + x^3$
$x << 1,$
$= 1 + 3x$

6. **(4)**

$y = e^{-\alpha x}$

$$\frac{dy}{dx} = -\alpha e^{-\alpha x}$$

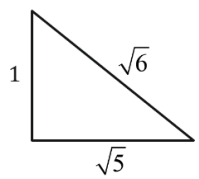
$$\boxed{\frac{d^2y}{dx^2} = +\alpha^2 e^{-\alpha x}}$$

$$= \alpha^2 e^{-\alpha x}$$

7. **(4)**

$$\cos(270 + 60) = \sin 60° = \frac{\sqrt{3}}{2}$$

8. **(1)**



$$\tan\theta = \frac{1}{\sqrt{5}}$$

9. **(4)**

$$S_\infty = \frac{a}{1-r} = \frac{1}{1-1/4} = \frac{4}{3}$$

10. **(2)**

The resultant of two forces of 10 N and 6 N lies between $(10+6)$N, , e. , 16 N and $(10-6)$N, , . e., 4 N . Hence, the possible value of resultant is 8 N ,

11. **(2)**

$$r = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$
$$\sqrt{(-2-2)^2 + (0-3)^2 + (5+7)^2} = 13$$

12. **(2)**

$$\tan\theta = \frac{\sqrt{3}}{1}$$
$$\theta = 60°$$

13. **(3)**

$\sin 15° = \sin(45 - 30)$
$\sin(A - B) = \sin A\cos B - \cos A\sin B$
$= \sin 45°\cos 30° - \cos 45°\sin 30°$

$$= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}} \times \frac{1}{2} = \frac{\sqrt{3}-1}{2\sqrt{2}}$$

14. **(1)**

$$\frac{\pi}{3} \times \frac{180}{\pi} = 60°$$

15. **(2)**

$$\frac{4\pi}{3} \times \frac{180}{\pi} = 240°$$

16. **(4)**

Fact

17. **(2)**

$$S = \frac{a}{1-r} = \frac{1}{1+\frac{1}{2}},\ a = 1,\ r = \frac{-1}{2} = \frac{2}{3}$$

18. **(4)**

$\log^{a^b = b\log a}$

$\log_{10}^{10} = 1$

19. **(4)**

$\log_2 x = (-5)$

$x = 2^{-5} = \dfrac{1}{2^5} \qquad \therefore x = \dfrac{1}{32}$

20. **(2)**

$\log_2 16$

$= \log_2 2^4 = 4 \log_2 2 = 4$

21. **(2)**

$\sqrt{3}y = 3x + 4$

$y = \sqrt{3}x + \dfrac{4}{\sqrt{3}}$

slope = $\sqrt{3}$

22. **(3)**

$P^2 = 2m$ E.

$m \propto P^2$

23. **(3)**

$v = 2t^2 + 4t$

$\dfrac{dv}{dt} = 4t + 4 = 4 \times 2 + 4 = 12$

24. **(4)**

Fact

25. **(1)**

$\vec{P} = \dfrac{1}{\sqrt{2}}\hat{i} + \dfrac{1}{\sqrt{2}}\hat{j} \therefore |\vec{P}| = \sqrt{\left(\dfrac{1}{\sqrt{2}}\right)^2 + \left(\dfrac{1}{\sqrt{2}}\right)^2} = 1$

$\therefore$ It is a unit vector.

26. **(3)**

$\int_0^1 (x^3 + 1)dx$

$= \left(\dfrac{x^4}{4} + x\right)_0^1 = \dfrac{1}{4} + 1 = \dfrac{5}{4}$

27. **(3)**

$\int e^{5x}dx = \dfrac{e^{5x}}{5} + C$

28. **(1)**

$\vec{C} = 5\hat{i} + 8\hat{j} + 2\hat{i} + 7\hat{j}$

$\vec{C} = 7\hat{i} + 15\hat{j}$

$|\vec{C}| + = \sqrt{7^2 + 15^2}$

$= \sqrt{274}$

29. **(1)**

Fact

30. **(2)**

Fact

31. **(3)**

$\vec{R} = \hat{i} + \hat{j} + \sqrt{2}\hat{k}$

Comparing the given vector with

$R = R_x\hat{i} + R_y\hat{j} + R_z\hat{k}$

$R_x = 1, R_y = 1, R_z = \sqrt{2}$

and $|\vec{R}| = \sqrt{R_x^2 + R_y^2 + R_z^2} = 2$

$\cos\alpha = \dfrac{R_x}{R} = \dfrac{1}{2} \Rightarrow \alpha = 60°$

$\cos\beta = \dfrac{R_y}{R} = \dfrac{1}{2} \Rightarrow \beta = 60°$

$\cos\gamma = \dfrac{R_z}{R} = \dfrac{1}{\sqrt{2}} \Rightarrow \gamma = 45°$

32. **(2)**

Fact

33. **(3)**

$\vec{C} = \vec{A} + \vec{B}$

$|\vec{C}| = A^2 + B^2 + 2AB\cos\theta$

$13^2 = 12^2 + 5^2 + 2 \times 12 \times 5\cos\theta$

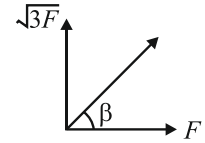
$\boxed{\cos\theta = 0}$

$\theta = \dfrac{\pi}{2}$

34. **(2)**

Fact

35. **(3)**



$\tan\beta = \dfrac{\sqrt{3}F}{F}$

$\tan\beta = \sqrt{3}$

$\boxed{\beta = 60°}$

36. **(1)**

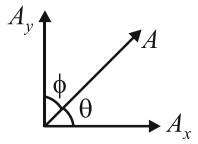
$\vec{C} = \vec{A} - \vec{B}$

and $C = \dfrac{\vec{C}}{|C|}$

37. **(1)**
Fact

38. **(3)**
$F_{max} = |F_1 + F_2|$
and
$F_{min} = |F_1 - F_2|$

39. **(2)**



$$\tan\phi = \frac{A_x}{A_y}$$

40. **(2)**

$$\sin\theta = \frac{B/\sqrt{2}}{B}$$

$$\sin\theta = \frac{1}{\sqrt{2}}$$

$$\theta = 45°$$

41. **(4)**

$$|B| = \sqrt{7^2 + (24)^2} = \sqrt{625} = 25$$

Unit vector in the direction of A will be

$$\hat{A} = \frac{3\hat{i} + 4\hat{j}}{5}$$

So required vector $= 25\left(\frac{3\hat{i} + 4\hat{j}}{5}\right) = 15\hat{i} + 20\hat{j}$

42. **(3)**
Differentiations of a constant is zero.

43. **(2)**

$$\vec{A} = \hat{i} + \hat{j} \Rightarrow |A| = \sqrt{1^2 + 1^2} = \sqrt{2}$$

$$\cos\alpha = \frac{A_x}{|A|} = \frac{1}{\sqrt{2}} = \cos 45° \ \therefore \ \alpha = 45°$$

44. **(3)**
Fact

45. **(1)**

$$\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k} \ \therefore$$

$$|\vec{A}| = \sqrt{(2)^2 + (4)^2 + (-5)^2} = \sqrt{45}$$

$$\therefore \ \cos\alpha = \frac{2}{\sqrt{45}}, \ \cos\beta = \frac{4}{\sqrt{45}}, \ \cos\gamma = \frac{-5}{\sqrt{45}}$$

46. **(1)**
Fact

47. **(1)**

$$\left|\vec{F}\right| = \sqrt{6^2 + 8^2 + 10^2} = \sqrt{200}$$

$$= 10\sqrt{2} \text{ N}$$

Hence, $m = \frac{F}{a} = \frac{10\sqrt{2} \text{ N}}{1} = 10\sqrt{2}$ kg.

48. **(2)**

$$(0.5)^2 + (0.8)^2 + c^2 = 1$$

$$c^2 = 1 - (0.5)^2 - (0.8)^2 = 1 - 0.25 - 0.64$$

$$= 1 - 0.89 = 0.11 \qquad \therefore \ c = \sqrt{0.11}.$$

49. **(3)**

$$\left|\vec{A} + \vec{B}\right| = |\vec{A} - \vec{B}|$$

$$A^2 + B^2 + 2AB\cos\theta = A^2 + B^2 - 2AB\cos\theta$$

$$\cos\theta = 0$$

$$\boxed{\theta = 90°}$$

50. **(1)**

$$P + Q = 18$$

Also $P^2 + Q^2 + 2PQ\cos\theta = (12)^2 = 144$

Also $\frac{Q\sin\theta}{P + Q\cos\theta} = \tan 90^\circ = \infty$

Therefore, $P + Q\cos\theta = 0$

Solving them, we find their magnitudes as 5 and 13.