NEET UG (2024)
Physics
Quiz-16

SECTION - A

1. If a vector $2\hat{i}+3\hat{j}+8\hat{k}$ is perpendicular to the vector $4\hat{j}-4\hat{i}+\alpha\hat{k}$. Then the value of α is

(1) –1 (2) $\frac{1}{2}$

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

2. If $\cos\theta = \frac{4}{5}$, then find the value of $\tan\theta$.

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

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

3. If $\vec{A}=4\hat{i}-3\hat{j}$ and $\vec{B}=6\hat{i}+8\hat{j}$, then magnitude and direction of $\vec{A}+\vec{B}$ will be:

(1) 5, $\tan^{-1}(3/4)$ (2) $5\sqrt{5}$, $\tan^{-1}(1/2)$

(3) 10, $\tan^{-1}(5)$ (4) 25, $\tan^{-1}(3/4)$

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

(1) 60° (2) 30°

(3) 45° (4) 0°

5. Which of the following is correct for $\sin(2\theta)$

(1) $2\sin\theta\cdot\cos\theta$ (2) $\sin^2\theta$

(3) $\sin^2\theta-\cos^2\theta$ (4) $2\sin\theta$

6. If a particle moves from point *P* (2, 3, 5) to point *Q* (3, 4, 5), its displacement vector be:

(1) $\hat{i}+\hat{j}+10\hat{k}$ (2) $\hat{i}+\hat{j}+5\hat{k}$

(3) $\hat{i}+\hat{j}$ (4) $2\hat{i}+4\hat{j}+6\hat{k}$

7. Find the value of cos 75°.

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

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

8. Gas bubble oscillates with a time period *T* proportional of $P^a d^b E^c$ where *P* is pressure, *d* is the density and *E* is the energy. The values of *a*, *b* & *c* are:

(1) $a=\frac{1}{2}, b=-\frac{1}{3}, c=\frac{1}{2}$

(2) $a=-\frac{5}{6}, b=\frac{1}{3}, c=\frac{1}{2}$

(3) $a=-\frac{5}{6}, b=\frac{1}{2}, c=\frac{1}{3}$

(4) $a=\frac{3}{2}, b=-\frac{1}{3}, c=\frac{1}{2}$

9. Suppose refractive index μ is given as:

$$\mu = A+\frac{B}{\lambda^2}$$

Where *A* and *B* are constants and λ is the wavelength, then dimensions of *B* are same as that of:

(1) Wavelength (2) Volume

(3) Pressure (4) Area

10. A wave is represented by $y = a\sin(At - Bx + C)$ where *A*, *B*, *C* are constants and t is in seconds and *x* is in meter. The dimensions of *A*, *B*, *C* are

(1) T^{-1}, L, $M^0 L^0 T^0$ (2) T^{-1}, L^{-1}, $M^0 L^0 T^0$

(3) T, L, M (4) T^{-1}, L^{-1}, M^{-1}

11. Calculate the dimensional formula of energy from the equation $E=\frac{1}{2}mv^2$

(1) $[M^0L^2T^2]$ (2) $[M^1L^2T^{-2}]$

(3) $[M^0L^2T^{-2}]$ (4) $[M^0L^{-2}T^{-2}]$

12. $\vec{A}=2\hat{i}+\hat{j}$, $\vec{B}=3\hat{j}-\hat{k}$ and $\vec{C}=6\hat{i}-2\hat{k}$. Value of $\vec{A}-2\vec{B}+3\vec{C}$ would be:

(1) $20\hat{i}+5\hat{j}+4\hat{k}$ (2) $20\hat{i}-5\hat{j}-4\hat{k}$

(3) $4\hat{i}+5\hat{j}+20\hat{k}$ (4) $5\hat{i}+4\hat{j}+10\hat{k}$

13. Find the value of $(1 + x)^3$, if $x << 1$.

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

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

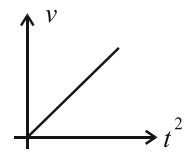
14. Find sum of infinite term in the given series.

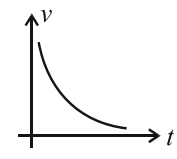
$1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+.....$

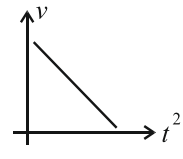
(1) $\frac{1}{2}$ (2) 1

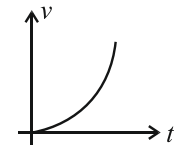
(3) 2 (4) $\frac{3}{2}$

15. If velocity *v* varies with time *t* as $v = t^2$, then the plot between *v* and t^2 will be given as:

(1) 

(2) 

(3) 

(4) 

16. The dimensions of $\frac{\alpha}{\beta}$ in the equation $F = \frac{\alpha - t^2}{\beta v^2}$, where F is the force, v is velocity and t is time, is

(1) $[MLT^{-1}]$ (2) $[ML^{-1}T^{-2}]$

(3) $[ML^3T^{-4}]$ (4) $[ML^2T^{-4}]$

17. If $y = \sin x$ and $x = 3t$, then $\frac{dy}{dt}$ will be:

(1) $3\cos(3t)$ (2) $\cos 3t$

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

18. Magnitude of vector which comes on addition of two vectors, $6\hat{i} + 7\hat{j}$ and $3\hat{i} + 4\hat{j}$ is:

(1) $\sqrt{136}$ (2) $\sqrt{13.2}$

(3) $\sqrt{202}$ (4) $\sqrt{160}$

19. $\frac{d}{dx}(\sin 30°)$ is equal to

(1) cos 30°

(2) cosec 30°

(3) 0

(4) sin 30°

20. In a new system of units, unit of mass is x kg, unit of length is y metre and unit of time is z second. Now if 1 newton = F new units then F =

(1) $\frac{z}{xy}$ (2) $\frac{z^2}{xy}$

(3) $\frac{z}{xy^2}$ (4) $\frac{z}{x^2y}$

21. If $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} - 2\hat{j} + 4\hat{k}$, then value of $|\vec{A} \times \vec{B}|$ will be

(1) $8\sqrt{2}$ (2) $8\sqrt{3}$

(3) $8\sqrt{5}$ (4) $5\sqrt{8}$

22. 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

(1) 90° (2) 0°

(3) 60° (4) 45°

23. The time dependence of physical quantity p is given by $p = p_0 \exp(-\alpha t^2)$, where α is a constant and t is the time. The constant α

(1) is dimensionless

(2) has dimensions $[T^{-2}]$

(3) has dimensions $[T^2]$

(4) has dimensions of p

24. If $y = \sin(2x + 3)$, then $\int y\,dx$ will be:

(1) $\frac{\cos(2x+3)}{2}$

(2) $-\frac{\cos(2x+3)}{2} + C$

(3) $-\cos(2x + 3)$

(4) $-2\cos(2x + 3)$

25. The unit vector along $\hat{i} + \hat{j}$ is:

(1) $\hat{k}$ (2) $\hat{i} + \hat{j}$

(3) $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$ (4) $\frac{\hat{i} + \hat{j}}{2}$

26. If frictional force acting on a body is directly proportional to its velocity then the dimensional formula of constant of proportionality is

(1) $[MLT^{-2}]$

(2) $[MLT^{-3}]$

(3) $[MT^{-3}]$

(4) $[MT^{-1}]$

27. $\frac{d}{dx}(\sin x \operatorname{cosec} x)$ is:

(1) $\sin^2 x - \operatorname{cosec}^2 x$

(2) x

(3) 0

(4) 1

28. 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

29. The dimensions of potential energy of an object in mass length and time are respectively

(1) 2, 2, 1 (2) 1, 2, –2

(3) –2, 1, 2 (4) 1, –1, 2

30. If $\vec{A} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} - 2\hat{j} + 4\hat{k}$, then value of $|\vec{A} \times \vec{B}|$ will be:

(1) $8\sqrt{2}$ (2) $8\sqrt{3}$

(3) $8\sqrt{5}$ (4) $5\sqrt{8}$

31. The pair of quantities having same dimensions is

(1) Displacement, velocity

(2) Time, frequency

(3) Wavelength, focal length

(4) Force, acceleration

32. Read the assertion and reason carefully to mark the correct option out of the options given below.

Assertion (A): $\vec{A}\times\vec{B}$ is perpendicular to both $\vec{A}+\vec{B}$ as well as $\vec{A}-\vec{B}$.

Reason (B): $\vec{A}+\vec{B}$ as well as $\vec{A}-\vec{B}$ lie in the plane containing $\vec{A}$ and $\vec{B}$, but $\vec{A}\times\vec{B}$ lies perpendicular to the plane containing $\vec{A}$ and $\vec{B}$.

(1) Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A).
(2) Both Assertion (A) and Reason (R) are the true but Reason (R) is not a correct explanation of Assertion (A).
(3) Assertion (A) is true and Reason (R) is false.
(4) Assertion (A) is false and Reason (R) is true.

33. Read the assertion and reason carefully to mark the correct option out of the options given below.

Assertion (A): $(\vec{A}+\vec{B})\neq(\vec{B}+\vec{A})$.

Reason (B): Vector addition is commutative.

(1) Both Assertion (A) and Reason (R) are the true and Reason (R) is a correct explanation of Assertion (A).
(2) Both Assertion (A) and Reason (R) are the true but Reason (R) is not a correct explanation of Assertion (A).
(3) Assertion (A) is true and Reason (R) is false.
(4) Assertion (A) is false and Reason (R) is true.

34. A particle moves with a velocity $6\hat{i}-4\hat{j}+3\hat{k}$ m/s under the influence of a constant force $\vec{F}=20\hat{i}+15\hat{j}-5\hat{k}\ N$. The instantaneous power applied to the particle is: (Hint : P = $\vec{F}.\ \vec{v}$)

(1) 32 J/s (2) 45 J/s
(3) 25 J/s (4) 195 J/s

35. If $y = t^3 + 2t + 3$, then find $\frac{d^2y}{dt^2}$.

(1) $8t$ (2) $4t$
(3) $6t$ (4) $3t$

SECTION - B

36. If $y = (\sin x)^2$, then find $\frac{dy}{dx}$.

(1) $2\sin x$ (2) $2\cos x$
(3) $2\sin x\,.\cos x$ (4) $2\cos^2 x$

37. $\int\left(\cos\frac{x}{2}-\sin\frac{x}{2}\right)^2 dx =$

(1) $x+\cos x+c$ (2) $2\cos^2\frac{x}{2}+c$

(3) $\frac{1}{3}\left(\cos\frac{x}{2}-\frac{x}{2}\right)^3+c$ (4) $x-\cos x+c$

38. Choose the wrong statement:

(1) All quantities may be represented dimensionally in terms of the base quantities.
(2) A base quantity cannot be represented dimensionally in terms of the rest of the base quantities.
(3) The dimension of a base quantity in other base quantities maybe zero.
(4) The dimension of a derived quantity is never zero in any base quantity.

39. Two forces $\hat{i}+\hat{j}+\hat{k}$ N and $\hat{i}+2\hat{j}+3\hat{k}$ N act on a particle and displace it from (2, 3, 4) to point (5, 4, 3). Displacement is in m. Work done is:

(1) 5 J (2) 4 J
(3) 3 J (4) None of these

40. Which of the following is correct for $(64)^{2/3}$

(1) 16 (2) 32
(3) 4 (4) 8

41. 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:

(1) 90° (2) 0°
(3) 60° (4) 45°

42. The dimensions of universal gravitational constant are

(1) $M^{-2}L^2T^{-2}$ (2) $M^{-1}L^3T^{-2}$
(3) $ML^{-1}T^{-2}$ (4) $ML^2\,T^{-2}$

43. In a new unit system, 1 unit of time is equal to 10 second, 1 unit of mass is 5 kg and 1 unit of length is 20 m. In the new system of units, 1 unit of energy is equal to:

(1) 20 Joule (2) $\frac{1}{20}$ Joule
(3) 4 Joule (4) 16 Joule

44. If we compare 3 units : millimeter, kilogram and micro second. Which unit is largest?

(1) Millimeter
(2) Microsecond
(3) Kilogram
(4) The units are not comparable

45. Velocity is a derived physical quantity which depends on _____ fundamental quantities.

(1) Zero (2) 1
(3) 2 (4) 4

46. Temperature can be expressed as a derived quantity in terms of any of the following

(1) Length and mass
(2) Mass and time
(3) Length, mass and time
(4) None of these

47. Kg m/s is a unit of

(1) Energy (2) Momentum
(3) Force (4) Pressure

48. The unit of potential energy is:

(1) $g(cm/\sec^2)$ (2) $g(cm/\sec)^2$
(3) $g(cm^2/\sec)$ (4) $g(cm/\sec)$

49. Which of the following is a characteristic of unit?

(1) Must be universally accepted.
(2) Must be well defined and invariable.
(3) Easily available and suitable size.
(4) All the above.

50. A wave is represented by y = a sin (At – Bx + C) where A, B, C are constants and t is in seconds and *x* is in meter. The dimensions of A, B, C are

(1) T^{-1}, L, $M^0 L^0 T^0$
(2) T^{-1}, L^{-1}, $M^0 L^0 T^0$
(3) T, L, M
(4) T^{-1}, L^{-1}, M^{-1}

Solution

1. (3)

Given vectors can be rewritten as

$\vec{A} = 2\hat{i} + 3\hat{j} + 8\hat{k}$ and $\vec{B} = -4\hat{i} + 4\hat{j} + \alpha\hat{k}$

Dot product of these vectors should be equal to zero because they are perpendicular.

$\therefore \quad \vec{A} \cdot \vec{B} = -8 + 12 + 8\alpha = 0$

$\Rightarrow \quad 8a = -4$

$\Rightarrow \quad \alpha = -1/2$

2. (4)

$$\cos\theta = \frac{B}{H} = \frac{4}{5}$$

$$P^2 = H^2 - B^2$$

$P = 3$

$$\tan\theta = \frac{P}{B} = \frac{3}{4}$$

3. (2)

NCERT Reference: Vector Addition – Analytical Method (Page no. 33 and 34)

$$\vec{A} + \vec{B} = 4\hat{i} - 3\hat{j} + 6\hat{i} + 8\hat{j} = 10\hat{i} + 5\hat{j}$$

$$|\vec{A} + \vec{B}| = \sqrt{(10)^2 + (5)^2} = 5\sqrt{5}$$

$$\tan\theta = \frac{5}{10} = \frac{1}{2} \Rightarrow \theta = \tan^{-1}\left(\frac{1}{2}\right)$$

4. (1)

π rad = 180°

5. (1)

Formula based

6. (3)

NCERT Reference: Topic- Position and Displacement Vectors (Page no. 28)

Displacement vector $\vec{r} = \Delta x\hat{i} + \Delta y\hat{j} + \Delta z\hat{k}$

$$= (3-2)\hat{i} + (4-3)\hat{j} + (5-5)\hat{k} = \hat{i} + \hat{j}$$

7. (1)

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

$$= \cos 45^\circ \cos 30^\circ - \sin 45^\circ \sin 30^\circ$$

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

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

8. (3)

Given, time period is proportional to $T \alpha p^n d^b E^c$ equating both sides of above equation ensionally, we get

$[M^0L^0T^{-1}] = [M^1L^{-2}T^{-1}]^a [M^1L^{-3}T^0]^b [M^1L^2T^{-2}]^c$

$[M^0L^0T^{-1}] = [M^{a+b+c} L^{-a-3b+2c} T^{-2a-2c}]$

Now, comparing the ensions of M, L, and T on both sides, we get

$a + b + c = 0$.....(1)

$-a - 3b + 2c = 0$.....(2)

$-2a - 2c = 0$.....(3)

Solving (1), (2) and (3), we get

$$a = -\frac{5}{6},\ b = \frac{1}{2} \text{ and } c = \frac{1}{3}$$

9. (4)

λ = wavelength

$$[\lambda] = L$$

$$\mu = (A) + \left(\frac{B}{\lambda^2}\right) \Rightarrow \left[\frac{B}{\lambda^2}\right] = M^0L^0T^0$$

$$\boxed{[B] = M^0L^2T^0}$$

B = S.I. unit (m^2)

10. (2)

$At - Bx + C$, in sin function required to dimensions less quantities, so $A = T^{-1}$, $B = L^{-1}$, C = constant

11. (2)

Dimensionally, E = mass × (velocity)^2

Since $\frac{1}{2}$ is a number and has no dimension.

$$\text{or } [E] = M \times \left(\frac{L}{T}\right)^2 = ML^2T^{-2}$$

12. (2)

NCERT Reference: Addition and Subtraction of Vectors (Page no. 29, 30 and 31)

$$\vec{A} - 2\vec{B} + 3\vec{C} = (2\hat{i} + \hat{j}) - 2(3\hat{j} - \hat{k}) + 3(6\hat{i} - 2\hat{k})$$

$$= 2\hat{i} + \hat{j} - 6\hat{j} + 2\hat{k} + 18\hat{i} - 6\hat{k} = 20\hat{i} - 5\hat{j} - 4\hat{k}$$

13. (3)

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

$x << 1$,

$= 1 + 3x$

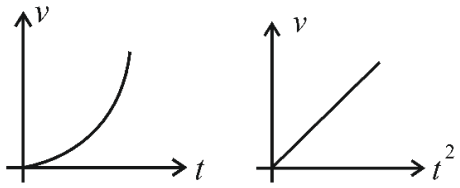
14. (3)

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

15. **(1)**

$v = t^2$

$v \uparrow \propto t^2 \uparrow$



16. **(3)**

$$F = \frac{\alpha - t^2}{\beta v^2}$$

Dimensionally, $\alpha = [T^2]$

$$[MLT^{-2}] = \frac{[T^2]}{\beta[L^2T^{-2}]}$$

$$\beta = \frac{T^2}{[MLT^{-2} \cdot L^2T^{-2}]}$$

$$\Rightarrow \quad \beta = [M^{-1}L^{-3}T^6]$$

Dimensions of

$$\frac{\alpha}{\beta} = \frac{T^2}{M^{-1}L^{-3}T^6} = [ML^3T^{-4}]$$

17. **(1)**

$y = \sin x, x = 3t$

$$\frac{dy}{dx} = \cos x, \frac{dx}{dt} = 3$$

$$\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt} = 3\cos x = 3\cos(3t)$$

18. **(3)**

NCERT Reference: Vector Addition – Analytical Method (Page no. 33 and 34)

$$\vec{R} = \vec{A} + \vec{B} = 6\hat{i} + 7\hat{j} + 3\hat{i} + 4\hat{j} = 9\hat{i} + 11\hat{j}$$

$$\therefore |\vec{R}| = \sqrt{9^2 + 11^2} = \sqrt{81 + 121} = \sqrt{202}$$

19. **(3)**

Differentiations of a constant is zero.

20. **(2)**

$$\frac{1 \text{ kg m}}{s^2} = \frac{F\,(x \text{ kg})\,(ym)}{(zs)^2}$$

$$\therefore \quad F = \frac{z^2}{xy}$$

21. **(2)**

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 1 & 2 \\ 2 & -2 & 4 \end{vmatrix}$$

$$= (1 \times 4 - 2 \times -2)i + (2 \times 2 - 4 \times 3)\hat{j} + (3 \times -2 - 1 \times 2)\hat{k}$$

$$= 8\hat{i} - 8\hat{j} - 8\hat{k}$$

$\therefore$ Magnitude of

$$\vec{A} \times \vec{B} = |\vec{A} \times \vec{B}| = \sqrt{(8)^2 + (-8)^2 + (-8)^2}$$

$$= 8\sqrt{3}$$

22. **(1)**

$$\cos\theta = \frac{\vec{A} \cdot \vec{B}}{|A||B|} = \frac{(3\hat{i} + 4\hat{j} + 5\hat{k})(3\hat{i} + 4\hat{j} - 5\hat{k})}{\sqrt{9 + 16 + 25}\sqrt{9 + 16 + 25}}$$

$$= \frac{9 + 16 - 25}{50} = 0$$

$\Rightarrow$ $\cos\theta = 0$, $\therefore$ $\theta = 90°$

23. **(2)**

$p = p_0 \exp(-\alpha t^2)$

As powers of exponential quantity is dimensionless, so αt^2 is dimensionless.

or αt^2 = dimensionless = $[M^0L^0T^0]$

$$\therefore \quad \alpha = \frac{1}{t^2} = \frac{1}{[T^2]} = [T^{-2}]$$

24. **(2)**

$y = \sin(2x + 3)$

Let $2x + 3 = t \Rightarrow 2dx = dt$

$$\Rightarrow \quad \int y dx = \int \sin(2x + 3) dx$$

$$= \int \sin t \frac{dt}{2} = \frac{1}{2}(-\cos(t)) = \frac{-\cos(2x + 3)}{2} + C$$

25. **(3)**

Unit vector along a vector $\vec{A}$ is given by $\hat{A} = \frac{\vec{A}}{|\vec{A}|}$

$\therefore$ Unit vector along $\hat{i} + \hat{j}$ is $\frac{\hat{i} + \hat{j}}{\sqrt{1^2 + \hat{1}^2}} = \frac{\hat{i} + \hat{j}}{\sqrt{2}}$

26. **(4)**

$F \propto V$

$$K = \frac{F}{V} = \frac{MLT^{-2}}{LT^{-1}} = [MT^{-1}]$$

27. **(3)**

$y = \sin x \operatorname{cosec} x$

Rule: Product rule

$$\frac{d}{dx}(uv) = v\frac{du}{dx} + u\frac{dv}{dx}$$

$$\cos ec\ x\frac{d}{dx}(\sin x)+\sin x\frac{d}{dx}(\cos ecx)$$

$$\left[\frac{d}{dx}(\sin x)=\cos x,\frac{d}{dx}(\text{cosec}\,x)=-\text{cosec}\,x\cot x\right]$$

$$\text{cosec}\,x\cos x+\sin x(-\text{cosec}\,x\cot x)$$

$$=\frac{1}{\sin x}\cos x-\sin x\times\frac{1}{\sin x}\cot x=\cot x-\cot x\ =0$$

28. (2)

vector quantity has direction and magnitude both but a scalar has only magnitude. If we consider null vector, it has zero magnitude and it has no direction or may have direction. Generally, the null vector is the resultant of two equal magnitude and opposite direction vectors. So we can say that the given quantity may be a vector.

The vector should also obey the triangular law of vectors. Hence, we can say that a given quantity may be a vector.

29. (2)

The dimensional formula of energy

$E = [ML^2T^{-2}]$

So, dimension of (i) Mass $\rightarrow$ 1 (ii) Length $\rightarrow$ 2

(iii) Time $\rightarrow -2$

30. (2)

NCERT Reference: Topic - Cross Product

$$\vec{A}\times\vec{B}=\begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ 3 & 1 & 2\\ 2 & -2 & 4\end{vmatrix}$$

$$=[1\times4-2(2\times-2)]\hat{i}+[2\times2-4\times3]\hat{j}+[(3\times-2)-(1\times2)]\hat{k}$$

$$=8\hat{i}-8\hat{j}-8\hat{k}$$

$\therefore$ Magnitude

$$\vec{A}\times\vec{B}=|\vec{A}\times\vec{B}|=\sqrt{(8)^2+(-8)^2+(-8)^2}\ =8\sqrt{3}$$

31. (3)

Unit of wavelength = m

Unit of focal length = m

32. (1)

NCERT Reference: Topic - Cross Product

Cross product of two vectors is perpendicular to the plane containing both the vectors.

33. (4)

Addition and Subtraction of Vectors Graphical Method (Page no. 29, 30 and 31)

Since vector addition is commutative, therefore $\vec{A}+\vec{B}=\vec{B}+\vec{A}$

34. (2)

NCERT Reference: Topic - Dot Product

$$P=\vec{F}\cdot\vec{v}=20\times6+15\times(-4)+(-5)\times3$$

$= 120 - 60 - 15 = 120 - 75 = 45$ J/s

35. (3)

$$\frac{dy}{dt}=\frac{d}{dt}\left(t^3+2t+3\right)=3t^2+2+0$$

$$\frac{d^2y}{dt^2}=\frac{d}{dt}\left(\frac{dy}{dt}\right)=\frac{d}{dt}\left(3t^2+2\right)=3(2t)+0$$

$= 6t$

36. (3)

$$\Rightarrow\quad\frac{dy}{dx}=\frac{d}{dx}(\sin x)^2$$

$$=2(\sin x)^{2-1}\frac{d}{dx}\sin x$$

By chain rule

$= 2 \sin x \cos x$

37. (1)

$$\int\left(\cos\frac{x}{2}-\sin\frac{x}{2}\right)^2dx$$

$$=\int\left\{\cos^2\frac{x}{2}+\sin^2\frac{x}{2}-2\sin\frac{x}{2}\cos\frac{x}{2}\right\}dx$$

$$=\int(1-\sin x)dx=x+\cos x+c$$

38. (4)

A dimensionally incorrect equation may be correct.

39. (1)

Work = $\vec{F}\cdot\vec{S}$

Here $\vec{F}=\left(\hat{i}+\hat{j}+\hat{k}\right)+\left(\hat{i}+2\hat{j}+3\hat{k}\right)$

$$=(2\hat{i}+3\hat{j}+4\hat{k})\text{ N}$$

$$\vec{S}=(5\hat{i}+4\hat{j}+3\hat{k})-(2\hat{i}+3\hat{j}+4\hat{k})$$

$$=(3\hat{i}+\hat{j}-\hat{k})\text{ m}$$

$\therefore$ Work $=(2\hat{i}+3\hat{j}+4\hat{k})\cdot(3\hat{i}+\hat{j}-\hat{k})$

$= (6 + 3 - 4)J = 5$ J

40. (1)

After simplify

$4 \times 4 = 16$

41. (1)

NCERT Reference: Topic – DOT Product

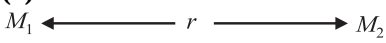
$$\cos\theta=\frac{\vec{A}\cdot\vec{B}}{|A||B|}=\frac{(3\hat{i}+4\hat{j}+5\hat{k})(3\hat{i}+4\hat{j}-5\hat{k})}{\sqrt{9+16+25}\sqrt{9+16+25}}$$

$$= \frac{9+16-25}{50} = 0$$

$\Rightarrow \quad \cos\theta = 0,$

$\therefore \quad \theta = 90°$

42. (2)



$$F = \frac{GM_1M_2}{r^2}$$

$$G = \frac{F.r^2}{M_1.M_2} \Rightarrow [G] = \frac{[MLT^{-2}].[L^2]}{[M^2]}$$

$$\boxed{[G] = [M^{-1}L^3T^{-2}]}$$

43. (1)

$$1J = \frac{1}{20}\frac{5kg.(20m)^2}{(10\sec)^2}$$

$$1\,\text{J} = \frac{1}{20}(\text{unit of energy})$$

1 unit = 20 J

44. (4)

All the units are of different physical quantities.

45. (3)

Velocity depends upon the length/time

46. (4)

Temperature is a fundamental unit

47. (2)

$P = mv$

48. (2)

$U = mgH$

$$= g \times \frac{cm}{s^2} \times cm$$

$$= g \times \frac{cm^2}{s^2} = g\left(\frac{cm}{\sec}\right)^2$$

49. (4)

Unit = universally accepted, well defined and easily available.

50. (2)

$At - Bx + C$, in sin function required to dimensions less quantities, so $A = T^{-1}$, $B = L^{-1}$, C = constant.