Q1. Which of the following is a vector quantity?

A) Speed
B) Distance
C) Displacement
D) Work

Answer: C) Displacement
Explanation:
Displacement has both magnitude and direction, so it is a vector. Others listed are scalars.

Q2. Two vectors A and B are such that |A| = 3 units and |B| = 4 units. If the angle between them is 90°, the magnitude of A + B is:

A) 1 unit
B) 7 units
C) 5 units
D) 6 units

Answer: C) 5 units
Explanation:
Use vector addition formula:

$|A + B| = \sqrt{(A^2 + B^2 + 2AB \cos\theta)}$

Here, $\cos 90° = 0 \Rightarrow$

$= \sqrt{(3^2 + 4^2)} = \sqrt{(9 + 16)} = \sqrt{25} = 5$ units

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Q3. The direction of the resultant of two vectors is given by:

A) $\cos^{-1}(B/A)$
B) $\tan^{-1}(B/A)$
C) $\tan^{-1}(A/B)$
D) $\sin^{-1}(A/B)$

Answer: B) $\tan^{-1}(B/A)$

Explanation:

For vectors at right angles:

$\tan \theta = (B \sin \theta) / (A + B \cos \theta)$

If $\theta = 90°$, then direction angle $= \tan^{-1}(B/A)$

Q4. Which of the following quantities has the unit m/s² and is a vector?

A) Velocity

B) Speed

C) Acceleration

D) Displacement

Answer: C) Acceleration

Explanation:

Acceleration is the rate of change of velocity and is a vector with SI unit m/s².

Q5. A projectile is launched with velocity u at an angle θ to the horizontal. What is the maximum height reached?

A) u² sin²θ divided by g

B) u² cos²θ divided by g

C) u sinθ divided by g

D) u² divided by g

Answer: A) u² sin²θ divided by g

Explanation:

Maximum height $H = (u^2 \sin^2\theta) / (2g)$

Q6. What is the horizontal range of a projectile launched with velocity u at angle θ?

A) $u^2 \sin^2\theta$ divided by g
B) $u^2 \sin2\theta$ divided by g
C) $u^2 \cos\theta$ divided by g
D) $u^2 \sin\theta \cos\theta$ divided by g

Answer: B) $u^2 \sin2\theta$ divided by g
Explanation:
Range R = $(u^2 \sin2\theta) / g$

Q7. What is the shape of the trajectory of a projectile?

A) Circle
B) Ellipse
C) Parabola
D) Hyperbola

Answer: C) Parabola
Explanation:
The path followed by a projectile under gravity (neglecting air resistance) is a parabola.

Q8. The time of flight of a projectile launched at angle θ with velocity u is:

A) (2u sinθ) divided by g
B) (u sinθ) divided by g
C) (u cosθ) divided by g
D) (u² sin2θ) divided by g

Answer: A) (2u sinθ) divided by g
Explanation:
Time of flight T = (2u sinθ) / g

Q9. If two vectors are equal in magnitude and opposite in direction, their resultant is:

A) Maximum
B) Zero
C) Minimum
D) Cannot be found

Answer: B) Zero

Explanation:

Equal and opposite vectors cancel each other $\Rightarrow$ resultant = 0

Q10. Which one of the following is true for projectile motion?

A) Vertical velocity remains constant
B) Horizontal acceleration is equal to g
C) Vertical acceleration is zero
D) Horizontal velocity remains constant

Answer: D) Horizontal velocity remains constant
Explanation:
In ideal projectile motion (no air resistance), horizontal velocity is constant; only vertical component changes due to gravity.

Q11. A particle moves with velocity v at an angle θ above the horizontal. What is the horizontal component of velocity?

A) v sinθ
B) v cosθ
C) v tanθ

D) v / cosθ

Answer: B) v cosθ
Explanation:
Horizontal component = v × cosθ
(Vertical component would be v sinθ)

Q12. The scalar product of two perpendicular vectors is:

A) Zero
B) Maximum
C) Minimum
D) Unity

Answer: A) Zero
Explanation:
Dot product A · B = AB cosθ
If θ = 90°, cosθ = 0 ⇒ scalar product = 0

Q13. The cross product of two vectors is a:

A) Scalar

B) Vector

C) Complex quantity

D) Dimensionless number

Answer: B) Vector

Explanation:

Cross product A × B = vector perpendicular to both A and B

Q14. A projectile has the same range R when projected at angles θ and (90° − θ). Which condition must be satisfied?

A) sinθ = cosθ

B) sin2θ = sin2(90° − θ)

C) θ = 45°

D) R = 0

Answer: B) sin2θ = sin2(90° − θ)

Explanation:

R = (u² sin2θ) / g ⇒ same range means same sin2θ

Since sin2θ = sin2(90° − θ), the condition holds

Q15. For a particle under projectile motion, which statement is not correct?

A) Acceleration remains constant
B) Horizontal range is maximum at 45°
C) Velocity is zero at the highest point
D) Horizontal velocity remains unchanged

Answer: C) Velocity is zero at the highest point
Explanation:
At highest point, only vertical velocity = 0. Horizontal velocity $\neq 0 \Rightarrow$ total velocity $\neq 0$

Q16. If the range of a projectile is R and the maximum height is H, then the ratio R divided by H is:

A) 4 cotθ
B) 4 tanθ
C) cotθ
D) tanθ

Answer: A) 4 cotθ
Explanation:

Range = (u² sin2θ) / g

Height = (u² sin²θ) / (2g)

⇒ R / H = (2 sin2θ) / sin²θ

Using identity: sin2θ = 2 sinθ cosθ

⇒ Ratio = 4 cotθ

Q17. The direction of the vector A × B is given by:

A) Along A

B) Along B

C) Perpendicular to both A and B

D) Same as A + B

Answer: C) Perpendicular to both A and B

Explanation:

Cross product of two vectors results in a vector perpendicular to both

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Q18. If a projectile is projected at an angle of 30° with initial speed 20 m/s, what is the maximum height? (Take g = 10 m/s²)

A) 5 m

B) 10 m

C) 15 m

D) 20 m

Answer: B) 10 m

Explanation:

H = (u² sin²θ) / (2g) = (20² × sin²30°) / (2 × 10)

= (400 × 1/4) / 20 = 100 / 20 = 5 m

⬜ Correct answer: A) 5 m (earlier B was mistakenly marked)

Q19. Which pair of vectors has maximum resultant?

A) Same magnitude and opposite direction

B) Same magnitude and perpendicular

C) Same magnitude and same direction

D) Unequal magnitudes and opposite directions

Answer: C) Same magnitude and same direction

Explanation:

Maximum resultant = A + B ⇒ occurs when θ = 0°

Q20. If two vectors have unequal magnitudes, can their sum be zero?

A) Yes
B) No
C) Only if perpendicular
D) Only if equal angles between them

Answer: B) No
Explanation:
Only two vectors with equal magnitudes and opposite directions can add up to zero

Q21. A ball is thrown horizontally from the top of a 45 m high building with speed 10 m/s. How far from the building will it strike the ground? (Take g = 10 m/s²)

A) 30 m
B) 45 m
C) 20 m
D) 10 m

Answer: A) 30 m
Explanation:

Time to fall = √(2h / g) = √(2 × 45 / 10) = √9 = 3 s
Horizontal distance = speed × time = 10 × 3 = 30 m

Q22. A vector has components 3î + 4ĵ. What is its magnitude?

A) 5
B) 7
C) 25
D) √13

Answer: A) 5
Explanation:
|A| = √(3² + 4²) = √(9 + 16) = √25 = 5

Q23. A projectile has horizontal range R and maximum height H. The time of flight in terms of R and H is:

A) √(2H/g)
B) √(2R/g)
C) √(4H/g)
D) R / √(2gH)

Answer: D) R / √(2gH)

Explanation:

From H = (u² sin²θ)/(2g), R = (u² sin2θ)/g ⇒

Using algebra: T = R / (u cosθ) and u sinθ = √(2gH) ⇒ T = R / √(2gH)

Q24. Which of the following represents a situation of non-uniform circular motion?

A) Car turning with constant speed

B) Electron revolving in hydrogen atom

C) Earth revolving around Sun in elliptical orbit

D) Object tied to a string moving in horizontal circle at constant speed

Answer: C) Earth revolving around Sun in elliptical orbit

Explanation:

In elliptical motion, speed and direction both vary ⇒ non-uniform circular motion

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Q25. A particle moves such that its position vector is r = 4î + 3ĵ. What is the angle with the x-axis?

A) 30°
B) 37°
C) 45°
D) 53°

Answer: D) 53°
Explanation:
$\tan\theta = y/x = 3/4 \Rightarrow \theta = \tan^{-1}(3/4) = 53°$

Q26. A projectile is thrown at angle 60° with speed 10 m/s. What is the time to reach max height? (g = 10 m/s²)

A) 1 s
B) 2 s
C) √3 s
D) 0.5 s

Answer: A) 1 s
Explanation:
$T/2 = u \sin\theta / g = (10 \times \sqrt3/2) / 10 = \sqrt3/2 \approx 0.866$ s
But actual sin60° ≈ 0.866, so T = (10 × 0.866) / 10 = 0.866 s

☒ Closest correct option: A) 1 s

Q27. If a vector has components along x and y axes as equal, then angle with x-axis is:

A) 30°
B) 45°
C) 60°
D) 90°

Answer: B) 45°
Explanation:
$\tan\theta = y/x = 1 \Rightarrow \theta = \tan^{-1}(1) = 45°$

Q28. What is the unit vector along the vector A = 6î − 8ĵ?

A) (3î − 4ĵ)/5
B) (6î − 8ĵ)/10
C) (6î − 8ĵ)/√100
D) (6î − 8ĵ)/√36

Answer: C) (6î − 8ĵ)/√100
Explanation:
|A| = √(36 + 64) = √100 ⇒ unit vector = A / |A| = (6î −
8ĵ)/√100

Q29. If a particle moves such that its acceleration is always
perpendicular to velocity, then:

A) Speed increases
B) Speed decreases
C) Path is linear
D) Speed remains constant

Answer: D) Speed remains constant
Explanation:
When acceleration ⊥ velocity, only direction changes;
magnitude (speed) stays constant.

Q30. If R is range, and u the speed of projection, which
expression gives angle for maximum range?

A) sinθ = 1
B) cosθ = 0
C) sin2θ = 1
D) tanθ = 1

Answer: C) sin2θ = 1
Explanation:
Maximum range when sin2θ = 1 ⇒ 2θ = 90° ⇒ θ = 45°

Q31. Two vectors of equal magnitude make an angle θ.
Resultant is maximum when:

A) θ = 90°
B) θ = 0°
C) θ = 60°
D) θ = 180°

Answer: B) θ = 0°
Explanation:
Resultant = √(A² + B² + 2AB cosθ)
Maximum when cosθ = 1 ⇒ θ = 0°

Q32. A vector A makes angle 30° with x-axis. What is its y-component if |A| = 10?

A) 10
B) 5
C) 10 sin30°
D) 10 cos30°

Answer: C) 10 sin30°
Explanation:
y-component = A sinθ = 10 × sin30° = 10 × 0.5 = 5

Q33. The magnitude of displacement after completing half circle of radius r is:

A) 2πr
B) πr
C) 0
D) 2r

Answer: D) 2r
Explanation:

Half circle $\Rightarrow$ displacement = straight-line distance between ends of diameter = 2r

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Q34. The dot product of a vector with itself is:

A) 1
B) 0
C) Its magnitude
D) Square of its magnitude

Answer: D) Square of its magnitude
Explanation:
$A \cdot A = |A|^2$

Q35. For a projectile, at what point is speed minimum?

A) At projection
B) At highest point
C) At landing
D) Cannot be determined

Answer: B) At highest point
Explanation:
At highest point, vertical velocity = 0 ⇒ total speed is only horizontal (minimum)

Q36. A projectile is launched with a speed of 40 m/s at 30°. What is the horizontal range? (Take g = 10 m/s²)

A) 80 m
B) 160 m
C) 120 m
D) 140 m

Answer: B) 160 m
Explanation:
Range,
, so
 m

Q37. A particle is acted upon by two perpendicular forces 3 N and 4 N. What is the magnitude of the resultant force?

A) 7 N

B) 5 N

C) 1 N

D) 12 N

Answer: B) 5 N

Explanation:

 N

Q38. If a projectile is thrown at angle θ and its complementary angle is 90° − θ, then the ratio of their maximum heights is:

A) 1

B) tan²θ

C) cot²θ

D) 1/tanθ

Answer: B) tan²θ

Explanation:

Height

For complementary angle, sin²(90° − θ) = cos²θ ⇒

Q39. A car takes a turn on a circular path with constant speed. Which of the following is true?

A) Linear velocity is constant
B) Angular velocity is zero
C) Acceleration is radially inward
D) Car is in equilibrium

Answer: C) Acceleration is radially inward
Explanation:
In uniform circular motion, acceleration (centripetal) is directed toward the center

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Q40. A plane is flying with velocity 200 m/s at 60° to the horizontal. What is the vertical component?

A) 100 m/s
B) 150 m/s
C) 173.2 m/s
D) 200 m/s

Answer: C) 173.2 m/s
Explanation:
 m/s

Q41. The angle between two vectors A and B is 90°, then what is |A × B|?

A) AB
B) A + B
C) 0
D) A/B

Answer: A) AB
Explanation:

Q42. A projectile reaches a height H in time T. What is the vertical component of initial velocity?

A) gT
B) gT/2

C) 2gT

D) √(2gH)

Answer: A) gT

Explanation:

At maximum height, vertical velocity = 0

Q43. The angle between vectors A = î + ĵ and B = î − ĵ is:

A) 0°

B) 45°

C) 90°

D) 180°

Answer: C) 90°

Explanation:

Dot product zero ⇒ angle = 90°

Q44. A body moves in a circular path of radius r with uniform speed v. Its angular velocity is:

A) v
B) v / r
C) v × r
D) v² / r

Answer: B) v / r
Explanation:
Angular velocity

Q45. If a projectile takes 4 s to reach max height, what is total time of flight?

A) 2 s
B) 4 s
C) 6 s
D) 8 s

Answer: D) 8 s
Explanation:
Time to reach max height = T/2 ⇒ total time = 2 × 4 = 8