



PHYSICS

BOOKS - VGS BRILLIANT PHYSICS (TELUGU ENGLISH)

MOTION IN A PLANE

Very Short Answer Questions 2 Marks

1. Write the equation for the horizontal range covered by a projectile and specify when it will

be maximum .



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2. The vertical component of a vector is equal to its horizontal component. What is the angle made by the vector with x-axis ?



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3. A vector V makes an angle θ with the horizontal. The vector is rotated through an angle

α . Does this rotation change the vector V ?



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4. Two forces of magnitudes 3 units and 5 units act at 60° with each other. What is the magnitude of their resultant ?



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5. $A = \vec{i} + \vec{j}$. What is the angle between the vector and x-axis ?



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6. When two right angled vectors of magnitude 7 units and 24 units combine, what is the magnitude of their resultant ?



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7. If $\vec{P} = 2i + 4j + 14k$ and $\vec{Q} = 4i + 4j + 10k$, find the magnitude of $\vec{P} + \vec{Q}$.



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8. Can a vector of magnitude zero have non-zero components ?



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9. What is the acceleration of a projectile at the top of its trajectory ?



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10. Can two vectors of unequal magnitude add up to give the zero vector ? Can three unequal vectors add up to give the zero vector ?



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Short Answer Questions 4 Marks

1. State parallelogram law of vectors . Derive an expression for the magnitude and direction of the resultant vector .



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2. Show that a boat must move at an angle with respect to river water in order to cross the river in minimum time .



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3. Define unit vector, null vector and position vector .



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4. If $|\bar{a} + \bar{b}| = |\bar{a} - \bar{b}|$ then find the angle between \bar{a} and \bar{b} .



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5. Show that the trajectory of an object thrown at certain angle with the horizontal is a parabola .



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6. Explain the terms the average velocity and instantaneous velocity . When are they equal ?



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7. Show that the maximum height and range of a projectile are $\frac{U^2 \sin^2 \theta}{2g}$ and $\frac{U^2 \sin 2\theta}{g}$ respectively where the terms have their regular meanings .



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8. If the trajectory of a body is parabolic in one frame, can it be parabolic in another frame that moves with a constant velocity with respect to the first frame? If not, what can it be?



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9. A force $(2\hat{i} + \hat{j} - \hat{k})N$ acts on a body which is initially at rest. At the end of 20 sec the velocity of the body is $(4\hat{i} + 2\hat{j} - 2\hat{k})ms^{-1}$, then mass of the body is



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Problems

1. Ship A is 10 km due west of ship b . Ship A is heading directly north at a speed of 30 km/h, while ship b is heading in a direction 60° west of north at a speed of 20 km/h .

(i) Determine the magnitude of the velocity of ship B relative to ship A .

(ii) What will be their distance of closest approach ?



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2. If θ is the angle of projection, R the range, h the maximum height, T the time of flight, then show that (a) $\tan \theta = 4h / R$ and (b) $h = gT^2 / 8$



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3. A Projectile is fired at an angle of 60° to the horizontal with an initial velocity of 800 m / s :

Find the time of flight of the projectile before it hits the ground .



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4. A Projectile is fired at an angle of 60° to the horizontal with an initial velocity of 800 m / s : Find the distance it travels before it hits the ground (range).



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5. A Projectile is fired at an angle of 60° to the horizontal with an initial velocity of 800 m / s :
Find the time of flight for the projectile to reach its maximum height .



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6. For a particle projected slantwise from the ground, the magnitude of its position vector with respect to the point of projection, when it is at the highest point of the path is found

to be $\sqrt{2}$ times the maximum height reached by it. Show that the angle of projection is $\tan^{-1}(2)$.



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7. An object is launched from a cliff 20 m above the ground at an angle of 30° above the horizontal with an initial speed of 30m/s. How far horizontally does the object travel before landing on the ground? ($g = 10m/s^2$)



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8. O' is a point on the ground chosen as origin . A body first suffers a displacement of $10\sqrt{2}$ mm North -East, next 10 m Noth and finally $10\sqrt{2}$ North-West . How far it is from origin ?



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9. From a point on the ground a particle is projected with initial velocity u , such that its

horizontal range is maximum. The magnitude of average velocity during its ascent is



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10. A particle is projected from the ground with some initial velocity making an angle of 45° with the horizontal. It reaches a height of 7.5 m above the ground while it travels a horizontal distance of 10 m from the point of projection . Find the initial speed of projection ($g = 10 \text{ m} / \text{s}^2$).



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11. Wind is blowing from the south at 5 m s^{-1} .

To a cyclist it appears to be blowing from the east at 5 m s^{-1} . Show that the velocity of the cyclist is m s^{-1} towards north-east .



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12. A person walking at 4 m/s finds rain drops falling slantwise into his face with a speed of 4 m/s at an angle of 30° with the vertical . Show

that the actual speed of the rain drops is 4 m/s .



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Additional Problems

1. The ceiling of a long hall is 25 m high . What is the maximum horizontal distance that a ball thrown with a speed of 40 m s^{-1} can go without hitting the ceiling of the hall ?



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2. A stone tied to the end of a string 80 cm long is whirled in a horizontal circle with a constant speed . If the stone makes 14 revolutions in 25 s, what is the magnitude and direction of acceleration of the stone ?



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3. An aircraft executes a horizontal loop of radius 1 km with a steady speed of 900 km/h .

Compare its centripetal acceleration with the acceleration due to gravity .



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4. An aircraft is flying at a height of 3400 m above the ground . If the angle subtended at a ground observation point by the air-craft positions 10 . 0 s apart is 30° , what is the speed of the aircraft ?



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5. A bullet fired at an angle of 30° with the horizontal hits the ground 3 . 0 km away. By adjusting its angle of projection, can one hope to hit a target 5 . 0 km away ? Assume the muzzle speed to be fixed, and neglect air resistance .



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