MOTION IN A PLANE

11th Standard CBSE

Date : 26-Nov-22

Physics

Reg.No. : | | | | | | |

Exam Time : 01:00:00 Hrs

Total Marks : 60

1) **1**

If $\vec{a_1}$ and $\vec{a_2}$ are two non collinear unit vectors and if $\left|\vec{a_1}+\vec{a_2}\right|=\sqrt{3}$, then the value of $\left(\vec{a_1}-\vec{a_2}\right).\left(2\vec{a_1}+\vec{a_2}\right)$ is

(a) 2 (b) $\frac{3}{2}$ (c) $\frac{1}{2}$ (d) 1

2) **1**

The sum of magnitudes of two forces acting at a point is 18 units and the magnitude of their resultant is 12 units. The resultant is at 90° with the force of the smaller magnitude. The magnitude of the individual forces is

(a) 5, 12 (b) 5, 13 (c) 6,14 (d) none of these

3) **1**

If the resultant of three forces $\vec{F}_1 = p\hat{i}+3\hat{j}-\hat{k}, \vec{F}_2$and $\vec{F}_3 = 6\hat{i}-\hat{k}$ acting on a particle has a magnitude equal to 5 units, then the value of p is

(a) -6 (b) -4 (c) 3 (d) 4

4) **1**

A vector is of magnitude $10\sqrt{3}$ units and making equal angles with the positive direction of x, y and z axis is

(a) $10\left(\hat{i}+\hat{j}+\hat{k}\right)$ (b) $10\left(\hat{i}+2\hat{j}+3\hat{k}\right)$ (c) $10\left(\hat{i}-\hat{j}-\hat{k}\right)$ (d) $10\left(\hat{i}-\hat{j}+\hat{k}\right)$

5) **1**

A body is projected horizontally with a velocity of 4 ms^{-1}. The velocity of the body after 0.7 s is nearly (take g = 10 ms^{-2})

(a) 10 ms^{-1} (b) 8 ms^{-1} (c) 19.2 ms^{-1} (d) 11 ms^{-1}

6) **1**

A particle moves on a given line with a constant speed v. At a certain time it is at a point P on its straight line path. O is fixed point. The value of $\vec{OP}\times\vec{v}$ is (where y is perpendicular distance from O to given line)

(a) $-yv\hat{k}$ (b) $-2yv\hat{k}$ (c) $-3yv\hat{k}$ (d) none

7) **1**

From the top of a tower of height 40 m, a ball is projected upwards with a speed of 20 m/ s at an angle of elevation of 30°. The ratio of the total time taken by the ball to hit the ground to its time of flight (time taken to come back to the same elevation) is (Take g = 10 m/s^2)

(a) 2:1 (b) 3:1 (c) 3:2 (d) 1.5:1

8) A boy aims a gun at a target from a point, at a horizontal distance of 100 m. if the gun can impart a horizontal velocity of 500 ms^{-1} to the bullet, the height above the target where he must aim his gun, in order to hit it is (Take g = 10 ms^{-2}) **1**

(a) 20 cm (b) 10 cm (c) 50 cm (d) 100 cm

9) At the top of the trajectory of a projectile, the directions of its velocity and accelerations are **1**

(a) parallel to each other (b) anti-parallel to each other (c) perpendicular to each other

(d) inclined to each other at an angle of 45°

10) A plane is indined at an angle of 30° with horizontal. The magnitude of component of a vector $\vec{A}$ =-10$\hat{k}$ perpendicular to this plane is (here z-direction is vertically upwards **1**

(a) $5\sqrt{2}$ (b) $5\sqrt{3}$ (c) 5 (d) 2.5

11) Which one of the following statements is true? **1**

(a) A scalar quantity is the one that is conserved in a process

(b) A scalar quantity is the one that can never take negative values

(c) A scalar quantity is the one that does not vary from one point to another in space

(d) A scalar quantity has the same value for observers with different orientation of the axes

12) Consider the quantities, pressure, power, energy, impulse, gravitational potential, electrical charge, temperature, area. Out of these, the only vector quantity lies is/ are **1**

(a) impulse, pressure and area (b) impulse (c) area and gravitational potential

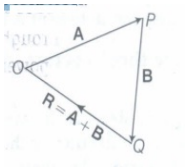
(d) impulse and pressure

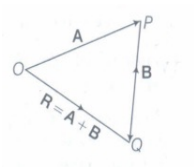
13) The relation between the vectors A and -2A is that, **1**

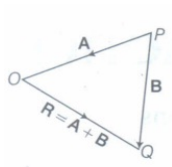
(a) both have same magnitude (b) both have same direction (c) they have opposite directions

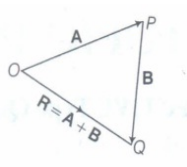
(d) None of the abov

14) A and B are two inclined vectors. R is their sum. Choose the correct figure for the given description **1**

(a) 

(b) 

(c) 

(d) 

15) The component of a vector r along X-axis will have maximum value if **1**

(a) r is along positive y-axis (b) r is along positive x-axis (c) r makes an angle of 45° with the x-axis

(d) r is along negative y-axis

16) Choose the correct option/ s. **1**

(a) To represent two-dimensional motion we need vectors

(b) To represent one-dimensional motion we use positive and negative signs

(c) To represent 3-dimensional motion we need vectors (d) All (a), (b) and (c)

17) $|\lambda \mathbf{A}| = \lambda |\mathbf{A}|$, if **1**

(a) $\lambda > 0$ (b) $\lambda < 0$ (c) $\lambda = 0$ (d) $\lambda \neq 0$

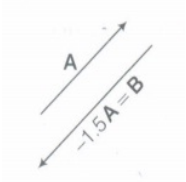
18) If A is a vector with magnitude IAI, then the unit vector it in the direction of vector A is **1**

(a) AA (b) A·A (c) A x A (d) $\frac{\mathbf{A}}{|\mathbf{A}|}$

19) Given $|\mathbf{A} + \mathbf{B}| = P$, $|\mathbf{A} - \mathbf{B}| = 0$ The value of $p^2 + Q^2$ is **1**

(a) $2(A^2 + B^2)$ (b) $A^2 - B^2$ (c) $A^2 + B^2$ (d) $2(A^2 - B^2)$

20) Choose the correct option regarding the given figure. **1**



(a) B = A (b) B = - A (c) I B I = I A I (d) $|\mathbf{B}| \neq |\mathbf{A}|$

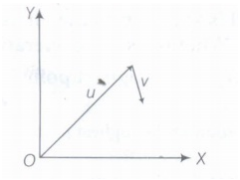
21) In a two dimensional motion, instantaneous speed V_o is a positive constant. Then, which of the following are necessarily true? **1**

(a) The acceleration of the particle is zero (b) The acceleration of the particle is bounded

(c) The acceleration of the particle is necessarily in the plane of motion

(d) The particle must be undergoing a uniform circular motion

22) Figure shows the orientation of two vectors u and v in the xy-plane **1**



If $\mathbf{u} = a\hat{\mathbf{i}} + b\hat{\mathbf{j}}$ and $\mathbf{v} = p\hat{\mathbf{i}} + q\hat{\mathbf{j}}$ Which of the following is correct?

(a) a and p are positive while band q are negative (b) a, p and b are positive while q is negative

(c) a, q and b are positive while p is negative (d) a, b, p and q are all positive

23) A man standing on a road has to hold his umbrella at 30° with the vertical to keep the rain away. He throws the umbrella and starts running at 10 kmh^{-1}. He finds that raindrops are hitting his head vertically. The actual speed of raindrops is **1**

(a) 20 kmh^{-1} (b) $10\sqrt{3} kmh^{-1}$ (c) $20\sqrt{3} kmh^{-1}$ (d) 10 kmh^{-1}

24) Three particles A, Band C projected from the same point with the same initial speeds making angle 30°,45° and 60°, respectively with the horizontally. Which of the following statements is correct? **1**

(a) A, B and C have unequal ranges (b) Ranges of A and C are less than that of B

(c) Ranges of A and C are equal and greater than that of B (d) A, Band C have equal ranges

25) The ceiling of a hall is 30 m high. A ball is thrown with 60 ms $^{-1}$ at an angle θ, so that maximum horizontal distance may be covered. The angle θ of projection is given by **1**

(a) $\sin\theta = \frac{1}{\sqrt{8}}$ (b) $\sin\theta = \frac{1}{\sqrt{6}}$ (c) $\sin\theta = \frac{1}{\sqrt{3}}$ (d) None of these

26) Two cars of masses m_1 and m_2 are moving in circles of radii r_1 and r_2 respectively. Their speeds are such that they make complete circles in the same time t. The ratio of their centripetal accelerations is **1**

(a) $m_1r_1 : m_2 r_2$ (b) $m_1 : m_2$ (c) $r_1 : r_2$ (d) 1: 1

27) In a two dimensional motion, instantaneous speed V_o is a positive constant. Then, which of the following are qecessarily true? **1**

(a) The average velocity is not zero at any time (b) Average acceleration must always vanish

(c) Displacements in equal time intervals are equa

(d) Equal path lengths are traversed in equal intervals

28) A particle starts from origin at t = 0 with a velocity $5.0\hat{\mathbf{i}}\text{ms}^{-1}$ nd moves in XY-plane under action of force which produces a constant acceleration of $(3.0\hat{\mathbf{i}} + 2.0\hat{\mathbf{j}})\text{ms}^{-2}$ .What is the y-coordinate of the particle at the instant when its x-coordinate is 84 m? **1**

(a) 36 m (b) 24 m (c) 39 m (d) 18 m

29) Two projectiles A and B thrown with speeds in the ratio $1:\sqrt{2}$ acquired the same height. If A is thrown at an angle of 45° with the horizontal, then angle of projection of B will be **1**

(a) 0° (b) 60° (c) 30° (d) 45°

30) If a person can throw a stone to maximum heiqht of h metre vertically, then the maximum distance through which it can be thrown horizontally by the same person is **1**

(a) $\frac{h}{2}$ (b) h (c) 2h (d) 3h

31) The displacement of a particle moving on a circular path of radius T when it makes 60° at the centre is **1**

(a) 2 r (b) r (c) $\sqrt{2}r$ (d) None of these

32) What is the position vector of a point mass moving on a circular path of radius of 10 m with angular frequency of 2 rads $^{-1}$ after $\pi/8$ s. Initially the point was on Y-axis. **1**

(a) $5\cdot(\hat{\mathbf{i}}+\hat{\mathbf{j}})$ (b) $5\sqrt{2}(\hat{\mathbf{i}}+\hat{\mathbf{j}})$ (c) $\hat{\mathbf{i}}+\hat{\mathbf{j}}$ (d) $\frac{1}{\sqrt{2}}(\hat{\mathbf{i}}+\hat{\mathbf{j}})$

33) The angle between $\mathbf{A} = \hat{\mathbf{i}} + \hat{\mathbf{j}}$ and $\mathbf{B} = \hat{\mathbf{i}} - \hat{\mathbf{j}}$ is **1**

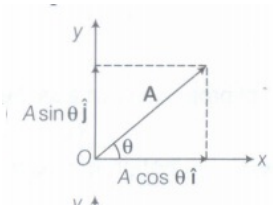
(a) 45° (b) 90° (c) - 45° (d) 180^0

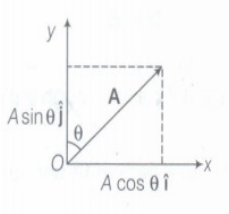
34) The quantities A_x and A_y are called x and y components of the vector A. Note that A_x is itself not a vector, but $A_x\,\hat{\mathbf{i}}$ is a vector, and so is $A_y\hat{\mathbf{j}}$. Using simple trigonometry, we can express A_x and A_y in terms of the magnitude of A and the angle it makes with the x-axis **1**

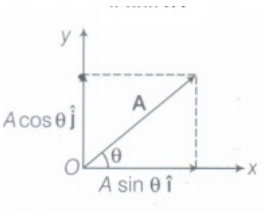
$A_x = A\cos\theta$

$A_y = A\sin\theta$

Choose the correct figure on the basis of given description.

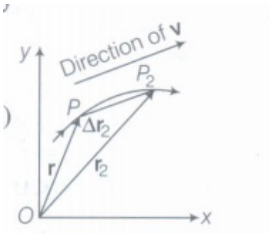
(a) 

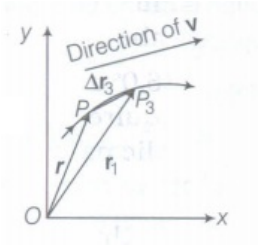
(b) 

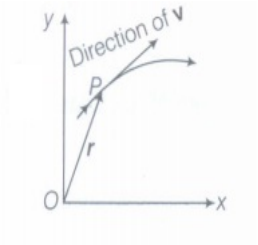
(c) 

(d) None of these

35) The direction of instantaneous velocity is shown by **1**

(a) 

(b) 

(c) 

(d) None of these

36) girl riding a bicycle with a speed of 5 ms $^{-1}$ towards North direction sees raindrops falling vertically downwards. On increasing the speed to 15 ms $^{-1}$ rain appears to fall making an angle of 45° of the vertical. Find the magnitude of velocity of rain. **1**

(a) 5 ms^{-1} (b) $5\sqrt{5}\ ms^{-1}$ (c) 25 ms^{-1} (d) 10 ms^{-1}

37) The speed of a projectile at the maximum height is 1/2 its initial speed. Find the ratio of range of projectile to the maximum height attained. **1**

(a) $4\sqrt{3}$ (b) $\frac{4}{\sqrt{3}}$ (c) $\frac{\sqrt{3}}{4}$ (d) 6

38) The horizontal range of a projectile fired at an angle of15° is 50 m. If it is fired with the same speed at an angle of 45°,its range will be **1**

(a) 60 m (b) 71 m (c) 100 m (d) 141 m

39) Two cars A and B move along a concentric circular path of radius r_A and r_B with velocities v_A and v_B maintaining constant distance, the $\frac{v_A}{v_B}$ is equal to **1**

(a) $\frac{r_B}{r_A}$ (b) $\frac{r_A}{r_B}$ (c) $\frac{r_A^2}{r_B^2}$ (d) $\frac{r_B^2}{r_A^2}$

40) The length of seconds hand of a watch is 1 cm, The change in velocity of its tip in 15 seconds in cm/s is **1**

(a) zero (b) $\frac{x}{(30\sqrt{2})}$ (c) $\frac{\pi}{30}$ (d) $\frac{2\pi}{(30\sqrt{2})}$

41) Five equal forces of 10 N each are applied at one point and are all lying in one plane. If the angles between them are equal, the resultant of these forces will be **1**

(a) Zero (b) 10 N (c) 20 N (d) $10\sqrt{2}N$

42) Angle that the vector $\vec{A} = 2\hat{i} + 2\hat{j}$ makes with y-axis is **1**

(a) $\tan^{-1}(3/2)$ (b) $\tan^{-1}(2/3)$ (c) $\sin^{-1}(2/3)$. (d) $\cos^{-1}(3/2)$

43) The simple sum of two forces acting at a point is 16 N and their sum is 8 N and its direction is perpendicular to the smaller force, then the forces are: **1**

(a) 6 Nand 10 N (b) 8 Nand 8 N (c) 4 Nand 12 N (d) 2 Nand 14 N

44) If a unit vector is represented by $\mathbf{0.5\hat{i} + 0.8\hat{j} + c\hat{k}}$ then the value of 'c' is **1**

(a) 1 (b) $\sqrt{0.11}$ (c) $\sqrt{0.01}$ (d) $\sqrt{0.39}$

45) A projectile is hurled into air from a point on the horizontal ground at an angle with the vertical. If the air exerts a constant resistive force, **1**

(a) the path of projectile will be parabolic path. (b) the time of ascent will be eq ual to time of decent.

(c) the total energy of the projectile is not conserved

(d) at the highest point, the velocity of projectile is horizontal.

46) A cart moves with a constant speed along a horizontal circular path. From the cart, a particle is thrown up vertically with respect to the cart, the particle will, **1**

(a) land outside the circular path. (b) land somewhere on the circular path.

(c) follow a parabolic path (d) follow an elliptical path.

47) A ball is bouncing elastically with a speed 1 m/s between walls of a railway compartment of size 10m in a direction perpendicular to walls. The train is moving at a constant velocity of 10 m/s parallel to the direction of motion of the ball. As seen from the ground, **1**

(a) the direction of motion of the ball changes every 10 seconds

(b) speed of ball changes every 10 seconds.

(c) average speed of ball over any 20 second interval is fixed.

(d) the acceleration of ball is the same as from the train.

48) Three vectors $\vec{A}, \vec{B}$ and $\vec{C}$ add up to zero. Find which is false **1**

(a) $\vec{A}(\vec{B} \times \vec{C})$ is not zero unless $\vec{B}, \vec{C}$ are parallel. (b) $\vec{A}(\vec{B} \times \vec{C})$ is zero unless $\vec{B}, \vec{C}$ are parallel.

(c) If $\vec{A}, \vec{B}, \vec{C}$ define a plane, $\vec{A} \times (\vec{B} \times \vec{C})$ is in that plane (d) $\vec{A}, (\vec{B}, \vec{C}) = |\vec{A} \parallel \vec{B} \parallel |\vec{C}| \rightarrow C^2 = A^2 + B^2$

49) It is found that $|\vec{A} + \vec{B}| = |\vec{A}|$ .This necessarily implies **1**

(a) $\vec{B} = \vec{0}$ (b) $\vec{A}, \vec{B}$ are antiparallel. (c) $\vec{A}, \vec{B}$ are perpendicular. (d) $\vec{A}, \vec{B} \leq 0$

50) Two particles are projected in air with speed V_0 at angles θ_1 and θ_2 (both acute) to the horizontal, respectively. If the height reached by the first particle is greater than that of the second, then tick the right choices **1**

(a) angle of projection: $q_1 > q_2$ (b) Time of flight: $T_1 > T_2$ (c) horizontal range: $R_1 > R_2$

(d) total energy: $U_1 > U_2$

51) A particle slides down a frictionless parabolic ($y = x^2$) track (A → B → C) starting from rest at point A (Fig.). Point B is at the vertex of parabola and point C is at a height less than that of point A. After C, the particle moves freely in air as a projectile. If the particle reaches highest point at P, then **1**

(a) KE at P = KE at B. (b) height at P = height at A (c) total energy at P = total energy at A

(d) time of travel from A to B = time of travel from B to P.

52) Following are four different relations about displacement, velocity and acceleration for the motion of a particle in general. Choose the incorrect one (s) : **1**

(a) $\vec{v}_{av} = \frac{1}{2}\left[\vec{v}\left(t_1\right) + \vec{v}\left(t_2\right)\right]$ (b) $\vec{v}_{av} = \frac{\vec{r}\left(t_2\right) - \vec{r}\left(t_1\right)}{t_2 - t_1}$ (c) $\vec{r} = \frac{1}{2}\left[\vec{v}\left(t_2\right) + \vec{v}\left(t_1\right)\right]\left(t_2 - t_1\right)$ (d) $\vec{a}_{av} = \frac{\vec{v}\left(t_2\right) - \vec{v}\left(t_1\right)}{t_2 - t_1}$

53) For a particle performing uniform circular motion, choose the correct statement(s) from the following: **1**

(a) Magnitude of particle velocity (speed) remains constant.

(b) Particle velocity remains directed perpendicular to radius vector.

(c) Direction of acceleration keeps changing as particle moves.

(d) Angular momentum is constant in magnitude but direction keeps changing.

54) A body is thrown with a velocity of 10 ms^{-1} at an angle of 60° with the horizontal. Its velocity at the highest point is **1**

(a) zero (b) 5 ms^{-1} (c) 10 ms^{-1} (d) 8.66 ms^{-1}

55) A person moves 30 m North, then 20 m East then $30\sqrt{2}$ m South-West. His displacement from the original position is **1**

(a) 14 m South-West (b) 28 m South (c) 10 m West (d) 15 m East

56) During projectile motion the quantities that remain unchanged are **1**

(a) force and vertical velocity (b) acceleration and horizontal velocity

(c) kinetic energy and acceleration (d) acceleration and momentum

57) A constant force is acting perpendicular to the velocity of a particle. For this situation which one is correct? **1**

(a) Velocity is constant. (b) Acceleration is constant (c) Momentum will be constant

(d) Particle will follow elliptical path.

58) The x-component of the resultant of several vectors **1**

(a) is equal to the sum of the x-cornponents of the vectors

(b) maybe equal to the sum of the magnitudes of the vectors.

(c) maybe smaller than the sum of the magnitude of the vectors.

(d) maybe greater than the sum of the magnitude of the vectors

59) The angle between $\vec{A} = \hat{i} + \hat{j}$ and $\vec{B} = \hat{i} - \hat{j}$ is **1**

(a) 45° (b) 90° (c) -45° (d) 180°

60) For two vectors $\vec{A}$ and $\vec{B}$ and $\vec{B}\,|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$ when: **1**

(a) $|\vec{A}| = |\vec{B}| \neq 0$ (b) $\vec{A} \perp \vec{B}$ (c) $|\vec{A}| = |\vec{B}| \neq 0$ and $\vec{A}$ and $\vec{B}$ are parallel or anti parallel.

(d) When either $|\vec{A}|$ or $|\vec{B}|$ is zero.

****

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

2) (b) 5, 13 **1**

3) (c) 3 **1**

4) (a) $10\left(\hat{i} + \hat{j} + \hat{k}\right)$ **1**

5) (b) 8 ms^{-1} **1**

6) (a) - y$\upsilon\hat{k}$ **1**

7) (a) 2:1 **1**

8) (a) 20 cm **1**

9) (d) inclined to each other at an angle of 45° **1**

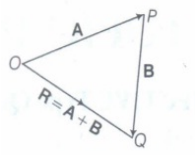
10) (b) $5\sqrt{3}$ **1**

11) (d) A scalar quantity has the same value for observers with different orientation of the axes **1**

12) (b) impulse **1**

13) (c) they have opposite directions **1**

14) (d) **1**



15) (b) r is along positive x-axis **1**

16) (d) All (a), (b) and (c) **1**

17) (a) $\lambda > 0$ **1**

18) (d) $\frac{\mathbf{A}}{|\mathbf{A}|}$ **1**

19) (a) $2(A^2 + B^2)$ **1**

20) (d) $|\mathbf{B}| \neq |\mathbf{A}|$ **1**

21) (c) The acceleration of the particle is necessarily in the plane of motion **1**

22) (b) a, p and b are positive while q is negative **1**

23) (a) 20 kmh^{-1} **1**

24) (b) Ranges of A and C are less than that of B **1**

25) (b) $\sin\theta = \frac{1}{\sqrt{6}}$ **1**

26) (c) $r_1 : r_2$ **1**

27) (d) Equal path lengths are traversed in equal intervals **1**

28) (a) 36 m **1**

29) (c) 30° **1**

30) (c) 2h **1**

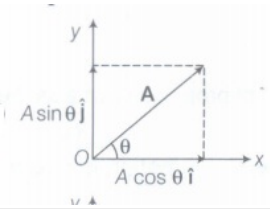
31) (b) r **1**

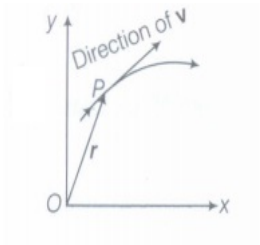
32) (b) $5\sqrt{2}(\hat{\mathbf{i}} + \hat{\mathbf{j}})$ **1**

33) (b) 90° **1**

34) **1**

(a)



35) (c) 

1

36) (b) $5\sqrt{5}\ \text{ms}^{-1}$ 1

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

38) (c) 100 m 1

39) (b) $\frac{r_A}{r_B}$ 1

40) 1

41) (a) Zero 1

42) (b) $\tan^{-1}(2/3)$ 1

43) (a) 6 Nand 10 N 1

44) (b) $\sqrt{0.11}$ 1

45) (a) the path of projectile will be parabolic path. 1

46) (a) land outside the circular path. 1

47) (b) speed of ball changes every 10 seconds. 1

48) (c) If $\vec{A}, \vec{B}, \vec{C}$ define a plane, $\vec{A} \times (\vec{B} \times \vec{C})$ is in that plane 1

49) (b) $\vec{A}, \vec{B}$ are antiparallel. 1

50) (a) angle of projection: $q_1 > q_2$ 1

51) (c) total energy at P = total energy at A 1

52) (a) $\vec{v}_{av} = \frac{1}{2}\left[\vec{v}\left(t_1\right) + \vec{v}\left(t_2\right)\right]$ 1

53) (a) Magnitude of particle velocity (speed) remains constant. 1

54) (b) 5 ms^{-1} **1**

55) (c) 10 m West **1**

56) (b) acceleration and horizontal velocity **1**

57) (b) Acceleration is constant **1**

58) (a) is equal to the sum of the x-cornponents of the vectors **1**

59) (b) 90° **1**

60) (b) $\vec{A} \perp \vec{B}$ **1**