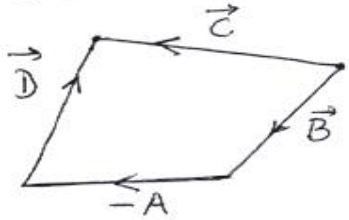
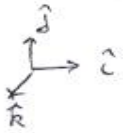
Fig (2) shows four vectors A, B, C, D. Which of the following statements is correct:



1) C = D + B − A
2) C = A + B + D
3) C = −D − B + A
4) C = A − B + D
5) C = −A − B − D

Unit vectors i,j,k have magnitudes of unity and are directed in the positive directions of the x,y,z axes. The value of k.(k x i) is:



$\hat{k} \times \hat{i} = \hat{j}$

$\hat{k} \cdot \hat{j} = 0 \quad (\hat{k} \cdot \hat{j} = |\hat{k}|\,|\hat{j}| \underbrace{\cos 90^\circ}_{=0})$

1) 0
2) −1
3) +1
4) i
5) j

If we have two vectors A = (a i − 2 j) and B = (2 i + 3 j) such that A.B = 4, find the value of a.

$\vec{A} \cdot \vec{B} = 2a - 6 = 4 \Rightarrow \boxed{a = 5}$

1) 5
2) 4
3) 0
4) −5
5) −4

A particle starts from the origin at t=0 with a velocity of (8j) m/s and moves in the xy plane with constant acceleration of (4i − 2j) m/s**2. At the instant the x coordinate of the particle is 32 m, what is the value of its y coordinate?

$\vec{v_0} = 0\hat{i} + 8\hat{j}$ (m/s)

$\vec{a} = 4\hat{i} - 2\hat{j}$ (m/s²)

$\vec{r} - \vec{r_0} = \vec{v_0}t + \frac{1}{2}\vec{a}t^2$

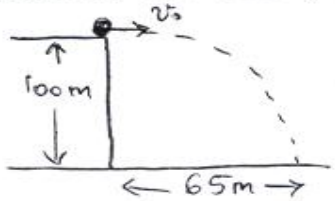
$\begin{cases} x = v_{0x}t + \frac{1}{2}a_x t^2 & (1) \\ y = v_{0y}t + \frac{1}{2}a_y t^2 & (2) \end{cases}$

(1) $\Rightarrow 32 = 0 \times t + \frac{1}{2} 4 \times t^2 \Rightarrow t = 4s$

(2) $\Rightarrow y = 8 \times 4 - \frac{1}{2} \times 2 \times 16 = \boxed{16m}$

1) 16 m
2) 35 m
3) 45 m
4) 32 m
5) 12 m

A ball is thrown horizontally from the top of a building 100 m high. The ball strikes the ground at a point 65 m horizontally away from the base of the building (Fig 3). What is the speed of the ball just before it strikes the ground?



$y - y_0 = v_0 \sin\theta_0 t - \frac{1}{2} g t^2$

$-100 = -4.9 t^2 \Rightarrow t = 4.5 sec$

$x - x_0 = v_0 \cos\theta_0 t = v_0 t \Rightarrow v_0 = \frac{65}{4.5} = 14.4 m$

$v_y = -gt = -9.8 \times 4.5 = -44.1 m/s$

$v = \sqrt{v_x^2 + v_y^2} = 46.4 m/s$

1) 47 m/s
2) 40 m/s
3) 37 m/s
4) 14 m/s
5) 50 m/s

A particle moves at a constant speed in a circular path with a radius of 2.0 cm. If the particle makes 4 revolutions each second, what is the magnitude of its acceleration?

$f = 4 \frac{rev}{s} = \frac{1}{T} \Rightarrow T = \frac{1}{4} s/rev$

frequency, period

$2\pi r = vT \Rightarrow v = \frac{2\pi r}{T} = \frac{2\pi \times 0.02}{1/4} = 0.5 m/s$

$a_r = \frac{v^2}{r} = 12.6 m/s^2$

1) 13 m/s**2
2) 20 m/s**2
3) 15 m/s**2
4) 18 m/s**2
5) 24 m/s**2