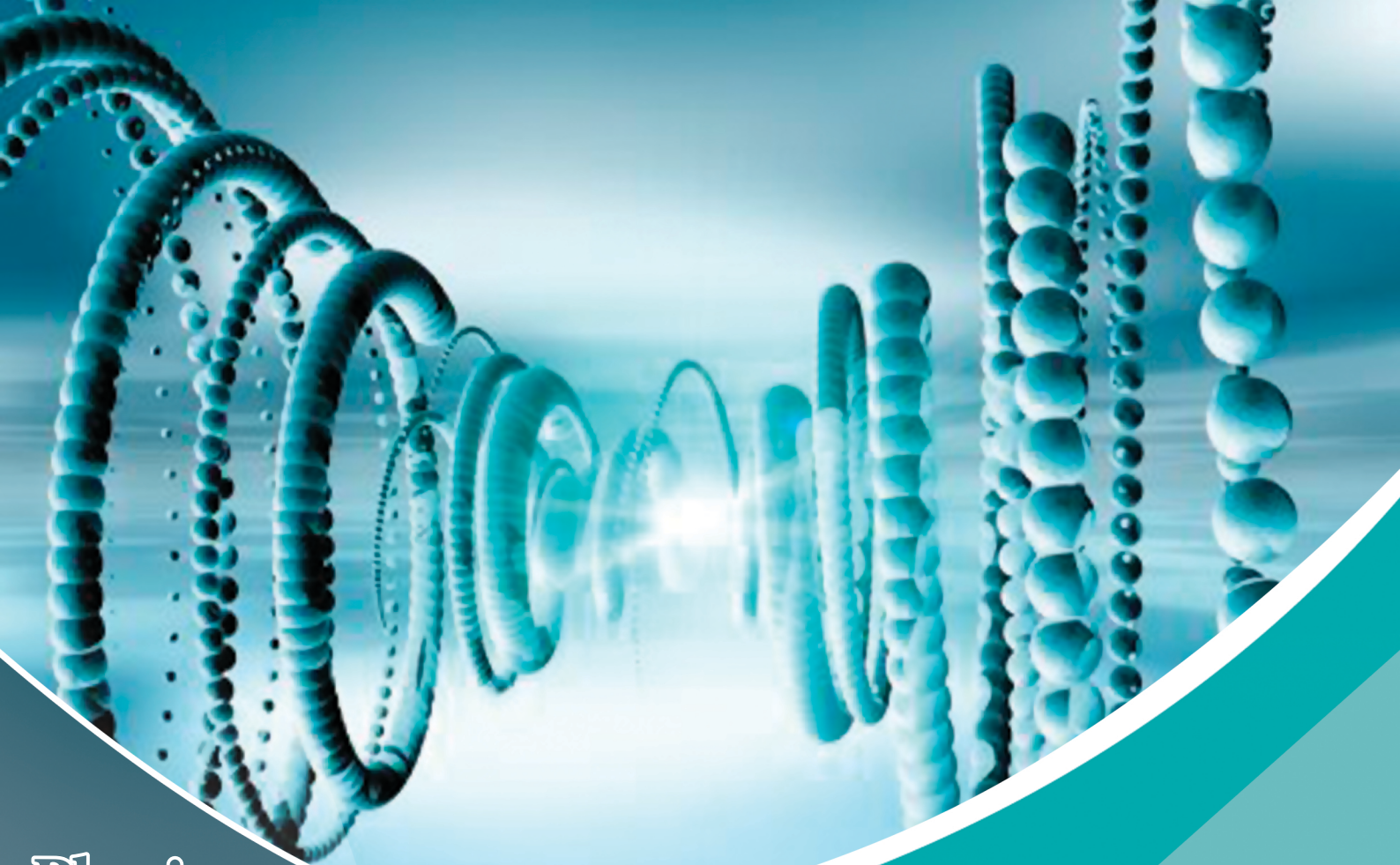


Physics

دبل الفزكس

101

Old Exams

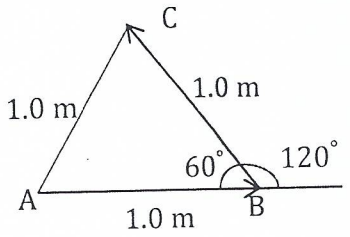
☎ 0502010680

CHAPTER

3

Initially an object moves 1.00 m in a straight-line from point A to point B. Then, it changes direction and moves another 1.00 m in a straight-line until it reaches point C. Point C is at a distance of 1.00 m from point A. Through what angle did the object changes its direction with respect to its initial direction of motion?

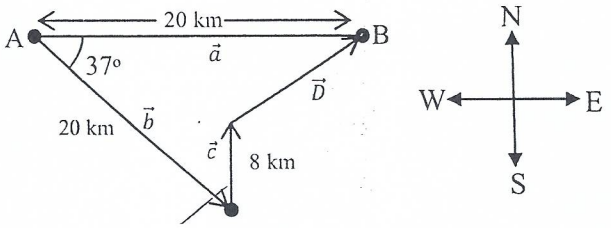
A) 120°
B) 70.0°
C) 100°
D) 135°
E) 140°

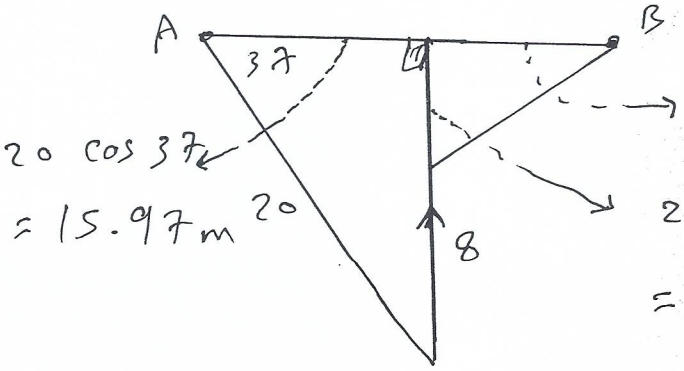


المثلث ABC متساوي الأضلاع
لذا تكون الزوايا الداخلية = 60°
اذا تكون زاوية B الخارجية = 120

Oasis B is 20 km due east of oasis A. Starting from Oasis A, a camel walks 20 km in a direction 37° south of east and then walks 8.0 km due north. How far is the camel then from oasis B?

A) 5.7 km
B) 4.0 km
C) 6.6 km
D) 2.7 km
E) 1.4 km

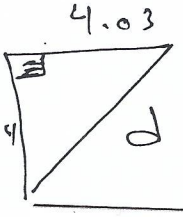




$\Rightarrow$ تكون المسافة الداخلية d

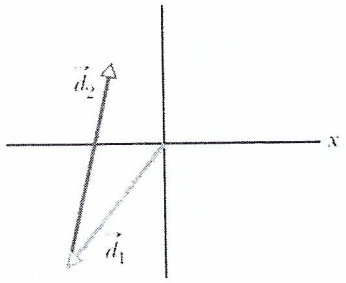
$$d = \sqrt{(4.03)^2 + (4.04)^2}$$

$$= 5.66 \simeq 5.7 \text{ km}$$



The two vectors shown in **Figure 2** lie in an *xy* plane. What are the signs of the *x* and *y* components, respectively, of the vector $(\vec{d}_2 - \vec{d}_1)$?

Figure 2



A) +,+
B) +, -
C) -, +
D) -, -
E) None of the other answers is correct.

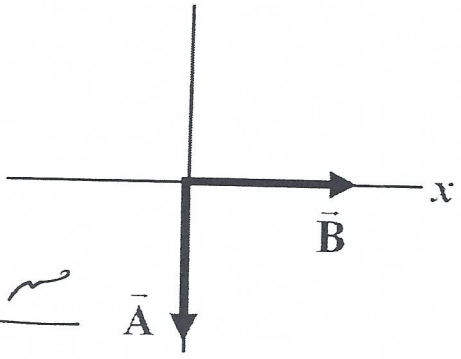
مسار رسم بحذاء d_{2x} موجبة و d_{2y} موجبة
و d_{1x} سالبة و d_{1y} سالبة

$\Rightarrow$ $d_{2x} - d_{1x}$ (+) و $d_{2y} - d_{1y}$ (+)

$\Rightarrow$ $\vec{d}_2 - \vec{d}_1 \Rightarrow$ +, +

The two vectors shown in **FIGURE 2** lie in the *xy* plane. Which of the following vectors has positive *x* and *y* components?

Figure # 2



A) $\vec{B} - \vec{A}$ ✓
B) $\vec{A} - \vec{B}$ *second quadrant*
C) $\vec{B} + \vec{A}$ fourth quadrant
D) $\vec{A} - 2\vec{B}$ second quadrant
E) $2\vec{A} - \vec{B}$ second quadrant

$B = \langle +, 0 \rangle$ من الشكل

$A = \langle 0, - \rangle \Rightarrow \vec{B} - \vec{A} = +, +$

The scalar product of vectors $\vec{A}$ and $\vec{B}$ is 6.00 and the magnitude of their vector product is 9.00. Find the angle between these two vectors.

A) 56.3°
B) 43.0°
C) 23.4°
D) 37.5°
E) 90.0°

$A \cdot B = AB\cos\theta = 6 \longrightarrow (1)$

$A \times B = AB\sin\theta = 9 \longrightarrow (2)$

$\Rightarrow$ نقسمة المعادلة 2 على 1

$\tan\theta = \frac{9}{6} = 1.5$

$\Rightarrow \theta = \tan^{-1}(1.5) = 56.3°$

Vector $\vec{A} = 1.00\,\hat{i} + 3.00\,\hat{j}$, vector $\vec{B} = 4.00\,\hat{i} - 1.00\,\hat{j}$ and the vector $\vec{C} = 2.00\,\hat{k}$.

Find the angle (in degrees) between vector $\vec{A}$ and vector $\vec{B} \times \vec{C}$.

A) 176
B) 103
C) 76.0
D) 1.1
E) 24.0

$\vec{B} \times \vec{C} = (4i - j) \times (2k) = -8j - 2i$

$A \cdot (B \times C) = (i + 3j)(-8j - 2i) = -26$

$|\vec{B} \times \vec{C}| = \sqrt{68}$

$|A| = \sqrt{10}$

$\Rightarrow \cos\theta = \dfrac{-26}{\sqrt{68} \cdot \sqrt{10}} = -0.99$

$\Rightarrow \theta = \cos^{-1}(-0.997) = 175.6 \simeq \underline{176}$

Two vectors are given by $\vec{A} = 2.00\hat{i} + 2.00\,\hat{j}$ and $\vec{B} = -2.00\hat{i} + 4.00\,\hat{j}$, find the angle between $\vec{A}$ and $\vec{B}$.

A) 71.6°
B) 45.0°
C) 56.1°
D) 18.4°
E) 24.5°

$A \cdot B = -4 + 8 = 4$

$|A| = \sqrt{8}$, $|B| = \sqrt{20}$

$\cos\theta = \dfrac{A \cdot B}{|A| \cdot |B|} = \dfrac{4}{\sqrt{8}\sqrt{20}} = 0.3162$

$\theta = \cos^{-1}(0.3162) = 71.565 \simeq 71.6$

Vector $\vec{A}$ has an *x* component of 3.0 m and a *y* component of −5.0 m, vector $\vec{B}$ has an *x* component of −4.0 m and a *y* component of 8 m. What are the magnitude of $\vec{A} \times \vec{B}$ and the angle it makes with the *xy* plane?

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

A) 4 m^2; 90°
B) 5 m^2; 90°
C) 4 m^2; 45°
D) 4 m^2; 180°
E) 6 m^2; 90°

$A \times B = 24k - 20k = 4k$

$\Rightarrow |A \times B| = \sqrt{4^2} = \boxed{4}$

$k \perp$ xy plane

What is the angle that vector $\vec{A} = -3\hat{i} - 4\,\hat{j}$ makes with the positive *x*–axis?

A) 127°
B) 147°
C) 137°
D) 133°
E) 90°

$\theta = 180 + \tan^{-1}\left(\frac{-4}{-3}\right) = 53 + 180 = 233$

or $\theta = 360 - 233 = \underline{127}$

وهو بطلعت

Vector $\vec{A}$ has a magnitude of 5.0 units and vector $\vec{B}$ has a magnitude of 10 units. Which of the following values is not possible for the scalar product of vectors $\vec{A}$ and $\vec{B}$?

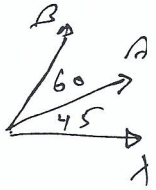
maximum scalar product

$\vec{A}\cdot\vec{B} = AB\cos\theta$

$= 5(10)(1) = 50$

A) 55 ✓
B) 45
C) 35
D) Zero
E) 25

A vector $\vec{\mathbf{A}}$ is defined by $\vec{\mathbf{A}} = 1.50\hat{\mathbf{i}} + 1.50\hat{\mathbf{j}}$. Find a vector $\vec{\mathbf{B}}$ that makes an angle of 60.0° with $\vec{\mathbf{A}}$ in the counterclockwise direction, and has a magnitude of 4.00 units.



مركبات (A) متساوية وموجبة

لذا تكون زاويتها = 45

وعليه تكون زاوية B = 105°

A) $\vec{\mathbf{B}} = -1.04\hat{\mathbf{i}} + 3.86\hat{\mathbf{j}}$
B) $\vec{\mathbf{B}} = 3.86\hat{\mathbf{i}} + 1.04\hat{\mathbf{j}}$
C) $\vec{\mathbf{B}} = 1.04\hat{\mathbf{i}} + 3.86\hat{\mathbf{j}}$
D) $\vec{\mathbf{B}} = -1.04\hat{\mathbf{i}} - 3.86\hat{\mathbf{j}}$
E) $\vec{\mathbf{B}} = 3.86\hat{\mathbf{i}} - 1.04\hat{\mathbf{j}}$

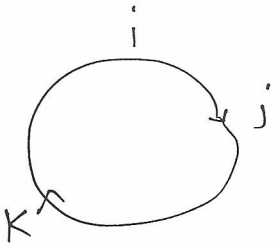
$\Rightarrow B = 4\cos 105\, i + 4\sin 105\, j$

$= -1.04\, i + 3.86\, j$

Three vectors are given by $\vec{\mathbf{A}} = 1.0\hat{\mathbf{i}} + 1.0\hat{\mathbf{j}}$, $\vec{\mathbf{B}} = -1.0\hat{\mathbf{j}} + 1.0\hat{\mathbf{k}}$, and $\vec{\mathbf{C}} = -1.0\hat{\mathbf{i}} + 1.0\hat{\mathbf{k}}$. Find $\vec{\mathbf{A}}\cdot(\vec{\mathbf{B}}\times\vec{\mathbf{C}})$.

$\vec{B}\times\vec{C} = (-j+k)\times(-i+k) =$

$= -k + i - j$



$\Rightarrow \vec{A}\cdot(B\times C)$

$= (i+j)\cdot(-k-i-j)$

$= -1-1 = -2$

A) −2.0
B) −4.0
C) +2.0
D) +4.0
E) 0

ch 3
1

Q7.

The vectors $\vec{X}$, $\vec{Y}$, and $\vec{Z}$ are related by $\vec{Z} = \vec{Y} - \vec{X}$. Which diagram shown in figure 3 illustrates this relationship?

A) E
B) B
C) C
D) D
E) A

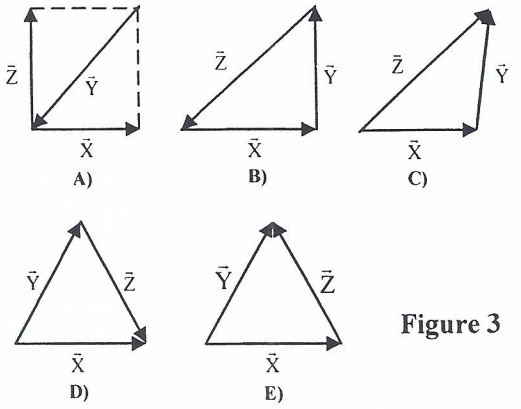
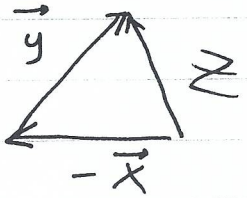


Figure 3

By adding vectors geometricaly



Q9.

In Figure 2, vector $\vec{A}$ has magnitude 12.0 m and vector $\vec{B}$ has magnitude 8.00 m. Vector $\vec{A} - \vec{B}$ is:

A) $(12.9\,\hat{i} + 6.40\,\hat{j})$ m
B) $(12.9\,\hat{i} + 14.4\,\hat{j})$ m
C) $(0.900\,\hat{i} - 14.4\,\hat{j})$ m
D) $(14.4\,\hat{i} + 12.9\,\hat{j})$ m
E) $(14.4\,\hat{i} + 0.900\,\hat{j})$ m

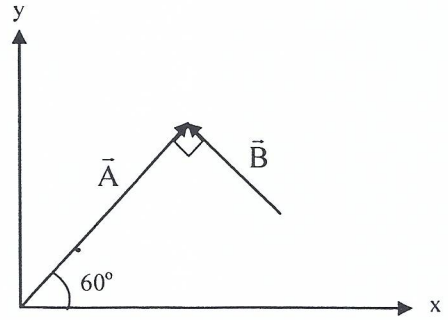


Figure 2

ch3
2

$$\vec{A} = (12\cos 60^\circ)\,i + (12\sin 60^\circ)\,j$$

$$= 6i + 10.4j$$

$$\vec{B} = (8\cos 150^\circ)\,i + (8\sin 150^\circ)\,j$$

$$= -6.93i + 4j$$

$$\Rightarrow \vec{A} - \vec{B} = (6 - -6.93)\,i + (10.4 - 4)\,j$$

$$= 12.93i + 6.4j$$

Q8.

Let $\vec{S} = \hat{i} - 2\hat{j} + 2\hat{k}$ and $\vec{T} = 3\hat{i} + 4\hat{k}$. The angle between these two vectors is:

A) 42.8^0
B) 29.9^0
C) 77.2^0
D) 21.0^0
E) 90.0^0

$$|S| = \sqrt{1 + (-2)^2 + 2^2} = \sqrt{9} = 3$$

$$|T| = \sqrt{3^2 + 4^2} = 5$$

$$\vec{S} \cdot \vec{T} = (1)(3) + 2(4) = 11$$

$$\cos\theta = \frac{S \cdot T}{|S| \cdot |T|}$$

$$= \frac{11}{(5)(3)} = \frac{11}{15} \Rightarrow$$

$$\theta = 42.83^\circ$$

Ch3
3

Q7.

Consider two non-zero vectors $\vec{A}$ and $\vec{B}$. If $\left|\vec{A}+\vec{B}\right|^2=\left|\vec{A}\right|^2+\left|\vec{B}\right|^2$, then:

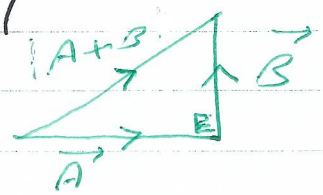
A) None of the other answers is true.
B) $\vec{A}$ and $\vec{B}$ must be parallel and in opposite directions.
C) The angle between $\vec{A}$ and $\vec{B}$ must be 45°.
D) The angle between $\vec{A}$ and $\vec{B}$ must be 60°.
E) $\vec{A}$ and $\vec{B}$ must be parallel and in the same direction.

$\cos 90 = 0$

$$|\vec{A}+\vec{B}|^2 = |\vec{A}|^2+|\vec{B}|^2-2|A|\cdot|B|\cos\theta$$

$$\text{So } |\vec{A}+\vec{B}| = |\vec{A}|^2+|B|^2$$

Just when $\theta = 90$



Q9.

If $\vec{d}_1=3\hat{i}-2\hat{j}$ and $\vec{d}_2=-5\hat{i}+2\hat{j}$, find $\left(\vec{d}_1+\vec{d}_2\right)\cdot\left(\vec{d}_1-\vec{d}_2\right)$.

A) −16
B) 8
C) 15
D) − 4
E) 0

$$\vec{d}_1+\vec{d}_2 = (3-5)i+(-2+2)j$$

$$= -2i$$

$$\vec{d}_1-\vec{d}_2 = (3--5)i+(-2-2)j$$

$$= 8i-4j$$

$$\Rightarrow (\vec{d}_1+\vec{d}_2)\cdot(\vec{d}_1-\vec{d}_2) = -2i\cdot(8i-4j)$$

$$= (-2)(8) = -16$$

ch3
4

Q8.
Two vectors are given as: $\vec{A} = 3.0\,\hat{i} + 4.0\,\hat{j} + 5.0\,\hat{k}$ and $\vec{B} = 5.0\,\hat{i} + 4.0\,\hat{j} + 3.0\,\hat{k}$. Find the angle between the vectors $\vec{A}$ and $\vec{B}$.

A) 23°
B) 28°
C) 33°
D) 38°
E) 45°

$$|\vec{A}| = \sqrt{3^2 + 4^2 + 5^2} = \sqrt{50}$$

$$|\vec{B}| = \sqrt{5^2 + 4^2 + 3^2} = \sqrt{50}$$

$$|\vec{A}| \cdot |\vec{B}| = (5)(3) + (4)(4) + (5)(3) = 46$$

$$\cos\theta = \frac{46}{50} = 0.92$$

$$\Rightarrow \quad \theta = 23^\circ$$

Q9.
Three vectors are given by $\vec{A} = 3.0\,\hat{i} + 3.0\,\hat{j}$, $\vec{B} = -1.0\,\hat{i} - 4.0\,\hat{j}$ and $\vec{C} = 2.0\,\hat{i} + 2.0\,\hat{j}$. Find $\vec{A} \cdot (\vec{B} \times \vec{C})$.

A) 0
B) −21
C) +26
D) −26
E) +5.0

$$\vec{B} \times \vec{C} = \{(-1.0)\,i - 4.0\,j\} \times \{2.0\,i + 2.0\,j\}$$

$$= -2k + 4k = 2k$$

$$\Rightarrow \vec{A} \cdot (\vec{B} \times \vec{C}) = (3.0\,i + 3.0\,j) \cdot 2k$$

$$= 0$$

Ch3
5

Q9.
If vector **A** is added to vector **B**, the result is (6 **i** + 1**j**) m. If **A** is subtracted from **B**, the result is (- 4 **i** + 7 **j**) m. Find the magnitude of **B**.

A) 4 m.
B) 8 m.
C) 2 m.
D) 1 m.
E) 9 m.

$$A + B = 6i + 1j \quad \rightarrow (1)$$

$$-A + B = -4i + 7j \quad \rightarrow (2)$$

$$(1) + (2) \Rightarrow \quad 2B = 2i + 8j$$

$$B = i + 4j$$

$$|B| = \sqrt{1^2 + 4^2}$$

$$= 4.1$$

$$= 4$$

3
1

6. Three vectors $\vec{A}$, $\vec{B}$, and $\vec{C}$ are such that: $\vec{C} = \vec{A} + \vec{B}$, $\vec{B} = 5\hat{i}$ nd $\vec{C} = 5\hat{j}$ Eind the angle between $\vec{A}$ and $\vec{B}$.
   A) 135°
   B) 120°
   C) 270°
   D) 150°
   E) 45°

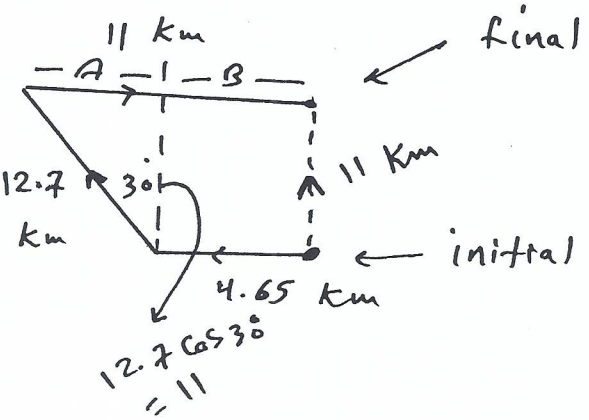
$$\vec{A} = \vec{C} - \vec{B}$$
$$= 5\hat{j} - 5\hat{i}$$

$$\cos\theta = \frac{\vec{A}\cdot\vec{B}}{|A|\cdot|B|} = \frac{(-5i+5j)(5i)}{\sqrt{50}\ \sqrt{25}}$$

$$= \frac{-25}{\sqrt{2}\sqrt{25}\sqrt{25}} = -\frac{1}{\sqrt{2}}$$

$$\therefore \theta = 135^\circ$$

7. A man walks 4.65 km West, then 12.7 km in the direction 30° West of North and finally 11.0 km due East. The man is now at
   A) 11.0 km due North
   B) 12.7 km due West
   C) 4.65 km due South
   D) 15.6 km in the direction 45° West of North
   E) back to where he started



$$A + B = 12.7\sin 30 + 4.65 =$$
$$6.35 + 4.65 = 11$$

8. If vector $\vec{A}$ has the magnitude of 3.0 m and makes an angle 30° with the +x-axis, then the vector $\vec{B} = -2\vec{A}$ is:

A) $\vec{B} = -5.2\hat{i} - 3.0\hat{j}\,(\text{m})$

B) $\vec{B} = 5.2\hat{i} + 3.0\hat{j}\,(\text{m})$

C) $\vec{B} = -5.2\hat{i} + 3.0\hat{j}\,(\text{m})$

D) $\vec{B} = 5.2\hat{i} - 3.0\hat{j}\,(\text{m})$

E) $\vec{B} = -3.0\hat{i} - 5.2\hat{j}\,(\text{m})$

$$\vec{A} = 3\cos 30\, i + 3\sin 30\, j$$
$$= 2.59\, i + 1.5\, j$$
$$\therefore -2\vec{A} = -5.196\, i - 3\, j$$

9. A ball is thrown with a velocity $\vec{v}_o = 3.0\hat{i} + 5.0\hat{j}\,(\text{m/s})$ from the ground. Its velocity just before it strikes the ground is:

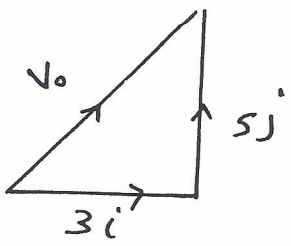
A) $\vec{v} = 3.0\hat{i} - 5.0\hat{j}\,(\text{m/s})$

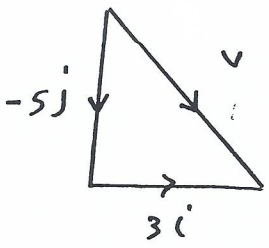
B) $\vec{v} = 3.0\hat{i} + 5.0\hat{j}\,(\text{m/s})$

C) $\vec{v} = 3.0\hat{i}\,(\text{m/s})$

D) $\vec{v} = 5.0\hat{j}\,(\text{m/s})$

E) $\vec{v} = -5.0\hat{j}\,(\text{m/s})$





3
3

Q1.

If $\vec{A} = (2.0\hat{i} - 3.0\hat{j})\,m$ and $\vec{B} = (1.0\hat{i} - 2.0\hat{j})\,m$, then $\vec{A} - 2\vec{B}$ =

A) $(-1.0\,\hat{j})$ m
B) $(1.0\,\hat{j})$ m
C) $(-4.0\,\hat{i} + 7.0\,\hat{j})$ m
D) $(4.0\,\hat{i} + 1.0\,\hat{j})$ m
E) $(4.0\,\hat{i} - 7.0\,\hat{j})$ m

$$\vec{A} - 2\vec{B} = (2i - 3j) - 2(i - 2j)$$
$$= (2-2)i + (-3+4)j$$
$$= (j)\ m$$

∴ Ans (B)

Q7.

Two vectors $\vec{A}$ and $\vec{B}$ have magnitudes of 10 m and 15 m respectively. The angle between them is 65°. The component (projection) of $\vec{B}$ along $\vec{A}$ is: 6.3

A) 0
B) 6.3 m
C) 7.5 m
D) 9.1 m
E) 4.2 m

$$\text{Proj}_{A}^{B} = \frac{A \cdot B}{|A|} = \frac{(10)(15)\cos 65^\circ}{10}$$

$$= 15\cos 65 = 6.3\ m$$

∴ Ans (B)

3
4

Q15.
A vector in the xy plane has a magnitude of 25 m and an x component of +12 m and a positive y component. The angle it makes with the positive y axis is:

A) 61°
B) 241°
C) 64°
D) 29°
E) 26°

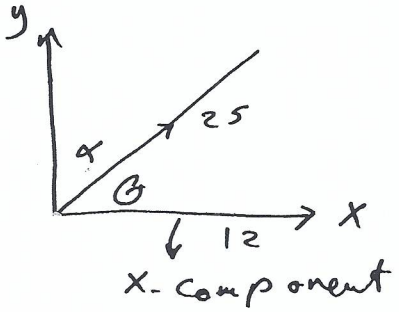
$12 = 25 \cos\theta$

$\cos\theta = \frac{12}{25}$

$= 0.48$

$\therefore \theta = 61^\circ$

$\therefore \alpha = 90 - 61 = 29^\circ$



Ans (D)

Q7.
$\vec{A}$ and $\vec{B}$ are two perpendicular vectors: $\vec{A} = 3.0\,\hat{i}$ and $\vec{B} = 2.0\,\hat{j}$. The magnitude of $\vec{A} - 2\vec{B}$ is:

A) 5.0.
B) 1.0.
C) 7.0.
D) − 1.0.
E) − 2.0.

(A)

$\vec{A} - 2\vec{B} = 3.0\hat{i} - 4.0\hat{j}$

$\therefore |A - 2B| = \sqrt{(3.0)^2 + (4.0)^2}$

$= 5.0$

Q8.

The angle between $\vec{A} = 3.00\,\hat{i} + 4.00\,\hat{j}$ and the negative y-axis is:

A) 143°
B) 61.0°
C) 29.0°
D) 209°
E) 241°

$$\cos\theta = \frac{(3.0\hat{i} + 4.0\hat{j}) \cdot (-\hat{j})}{\sqrt{(3.0)^2 + (4.0)^2}\;\;(\sqrt{(-1)^2})}$$

$$= \frac{-4}{5}$$

$$\therefore \theta = 143.130°$$

Q9.

Three vectors are given as: $\vec{A} = -3.0\,\hat{i}, \vec{B} = -5.0\,\hat{k}$ and $\vec{C} = 2.0\,\hat{j}$. The value of $\vec{A} \cdot (\vec{B} \times \vec{C})$ is:

A) -30
B) 0
C) $30\,\hat{k}$
D) $-30\,\hat{j}$
E) 10

$$\vec{A} \cdot (\vec{B} \times \vec{C}) = (-3.0)\hat{i} \cdot (-5.0\hat{k} \times 2.0\hat{j})$$

$$= (-3.0)\hat{i} \cdot (-10(-\hat{i}))$$

$$= (-3.0)\hat{i} \cdot 10\,\hat{i}$$

$$= -30$$

CHAPTER

4

The position of a particle is given by $\vec{r} = (4t - t^2)\,\hat{i} + t^3\,\hat{j}$, where $\vec{r}$ is in meters and t in seconds. Find the average acceleration (in m/s^2) of the particle in the time interval between t = 2 s and t = 4 s.

A) $-2\,\hat{i} + 18\,\hat{j}$
B) $-4\,\hat{i} - 6\,\hat{j}$
C) $-5\,\hat{i} - 10\,\hat{j}$
D) $-7\,\hat{i} - 12\,\hat{j}$
E) $-10\,\hat{i} - 6\,\hat{j}$

$r = (4t - t^2)\,i + t^3\,j$

$v = (4 - 2t)\,i + 3t^2\,j$

$v\Big|_{t=2} = (4-4)\,i + 3(4)\,j = 12\,j$

$v\Big|_{t=4} = (4-8)\,i + 3(16)\,j = -4i + 48j$

$\Longrightarrow \quad a\Big|_{2\to4} = \dfrac{v_4 - v_2}{4-2} = \dfrac{-4i + (48-12)j}{2}$

$= -2i + 18j$

A particle's position vector is initially $\vec{r} = 10.0\hat{i} - 12.0\,\hat{j} + 4.0\,\hat{k}$, and 10 s later it is $\vec{r} = -4.0\hat{i} + 16.0\,\hat{j} - 4.0\,\hat{k}$, all in meters. In unit vector notation, what is its $\vec{v}_{avg}$ during the10 s?

A) $-1.4\,\hat{i} + 2.8\,\hat{j} - 0.8\,\hat{k}$
B) $+1.4\,\hat{i} + 2.8\,\hat{j} - 0.8\,\hat{k}$
C) $-1.4\,\hat{i} - 2.8\,\hat{j} - 0.8\,\hat{k}$
D) $-1.4\,\hat{i} + 2.8\,\hat{j} + 0.8\,\hat{k}$
E) $+1.4\,\hat{i} - 2.8\,\hat{j} + 0.8\,\hat{k}$

$v_{avg} = \dfrac{\Delta r}{\Delta t} = \dfrac{r_f - r_i}{10}$

$= \dfrac{(-4-10)\,i + (16 - -12)\,j + (-4-4)\,k}{10}$

$= \dfrac{-14i + 28j - 8k}{10} = -1.4i + 2.8j - 0.8k$

The position function (x) of a particle moving along an x axis is $x = 1.0 + 8.0t - 2.0t^2$, with x in meters and the time (t) in seconds. Where does the particle stop momentarily?

A) 9.0 m
B) Zero
C) 1.0 m
D) 8.0 m
E) – 1.0 m

$x = 1 + 8t - 2t^2$

$v = \dfrac{dx}{dt} = 8 - 4t$

The particle stop momentary at $v = 0$

$\Longrightarrow \quad 8 - 4t = 0$

$t = \dfrac{8}{4} = 2$ sec.

$\Longrightarrow x\Big|_{t=2} = 1 + 8(2) - 2(2)^2 = 9$ m

10. A ball is kicked from the ground with an initial speed of 20 m/s at an angle of 45°. A player 60 m away starts running to catch the ball at that instant (see Fig 2). What must be his average speed (v) if he has to catch the ball just before it hits the ground?

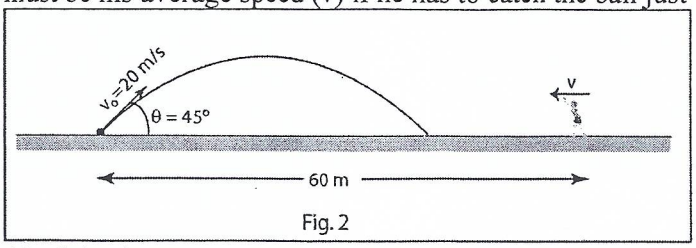


Fig. 2

A) 6.6 m/s
B) 10 m/s
C) 20 m/s
D) 2.0 m/s
E) 15 m/s

$$t_{total} = \frac{2 V_o \sin 45^\circ}{g}$$

$$= \frac{(2)(20)\sin 45^\circ}{9.8}$$

$$= 2.89 \text{ s}$$

$$R = (V_o \cos 45)\, t$$

$$= 40.87 \text{ m}$$

The distance which the player runs $= 60 - 40.87$

$= 19.129 \Rightarrow v = \frac{19.129}{2.89} = 6.61$ m/s

(79)

11. The position of a particle as a function of time is given by $\vec{r} = 3.0t\,\hat{i} + 2.0t^2\,\hat{j}$. Find the angle between the velocity and acceleration of the particle at t =5.0 s.

A) 8.5°
B) 0°
C) 90°
D) 45°
E) 78°

$$\vec{r} = 3t\,i + 2t^2\,j$$

$$\vec{v} = 3\,i + 4t\,j$$

$$\vec{a} = 4\,j$$

$$\therefore \cos\theta = \frac{\vec{v}\cdot\vec{a}}{|v|\cdot|a|} = \frac{(3i + 4tj)\cdot(4j)}{\sqrt{9+16t^2}\cdot\sqrt{16}}$$

when $t = 5\ s$

$$\cos\theta = \frac{4(5)(4)}{\sqrt{9+16(25)}\cdot\sqrt{16}}$$

$$\theta = 8.53^\circ$$

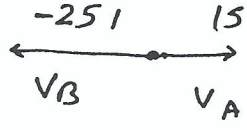
12. Car A is moving towards East with speed 15.0 m/s and car B is moving towards West with speed 25.0 m/s, both relative to the ground. Find the velocity of car B relative to car A.
    A) 40.0 m/s towards West
    B) 5.00 m/s towards West
    C) 5.00 m/s towards North
    D) 40.0 m/s towards East
    E) 40.0 m./s towards South

$$V_{BA} = V_B - V_A$$

$$= (-25 - 15)\,i$$

$$= -40\,i$$

means 40 m/s towards West.



Q9.
A boy wishes to swim across a river from *A* to *B*. He can swim at 1.0 m/s in still water and the river is flowing at 0.50 m/s (Fig 3). At what angle θ should he be heading?

A) 60°
B) 70°
C) 30°
D) 20°
E) 45°

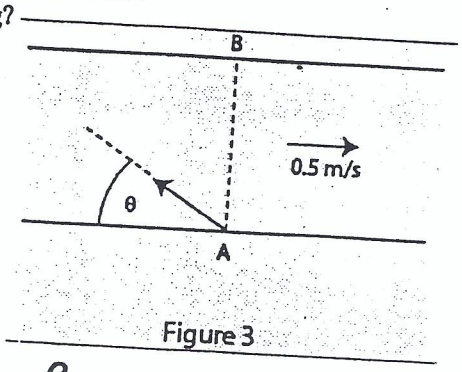
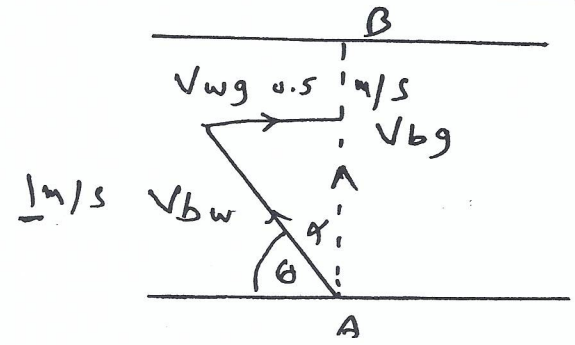


Figure 3



$\vec{V}_{bg} = \vec{V}_{bw} + \vec{V}_{wg}$

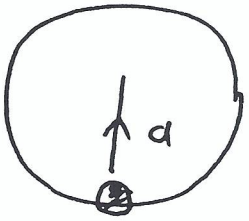
$\sin\alpha = \cos\theta = \frac{0.5}{1} = 0.5$

$\therefore \theta = 60°$

∴ Ans (A)

Q13.
A stone is tied to a 0.50 m string and rotated at a constant speed of 2.0 m/s in a vertical circle. Its acceleration at the bottom of the circle is:

A) 9.8m/s^2, down
B) 32 m/s^2, up
C) 8.0m/s^2, down
D) 8.0 m/s^2, up
E) 9.8 m/s^2, up



$a = \frac{v^2}{r}$

$= \frac{(2)^2}{0.5} = \frac{4}{0.5}$

$= 8 \text{ m/s}^2$

∴ Ans (D)

4

Y

Q18.

An arrow is shot horizontally from a point P toward X as shown in Fig 2. It hits at a point Y, t = 0.20 s later. If the speed of the arrow at P is v_0= 11 m/s, the distance PX is:

A) 1.8 m
B) 0.5 m
C) 1.0 m
D) 0.1 m
E) 2.2 m

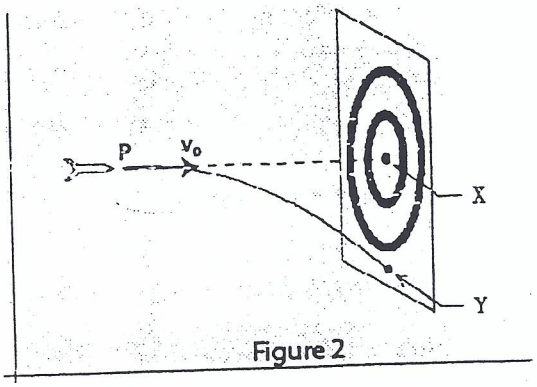


Figure 2

$$\Delta X = V_0 \cos\theta_0 t$$

$$= (11)(\cos 0)(0.2)$$

$$= 2.2 \text{ m}$$

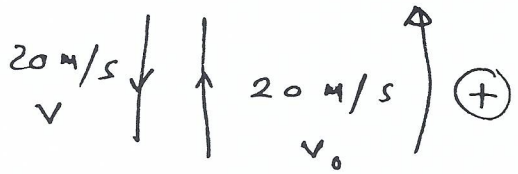
Ans (E)

Q20.

A train traveling north at 20 m/s turns and then travels south at 20 m/s. The change in its velocity is:

A) 0 m/s
B) 20 m/s north
C) 20 m/s south
D) 40 m/s north
E) 40 m/s south

$$\Delta V = V - V_0$$



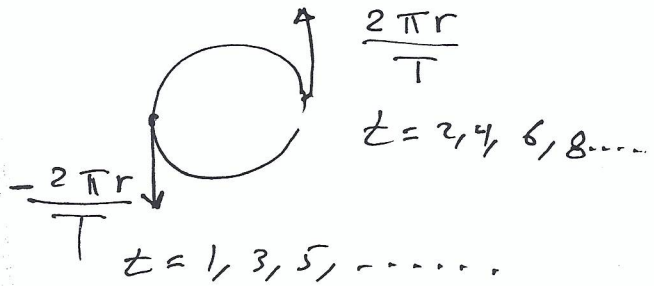
$$= -20 - 20$$

$$= -40 \text{ m/s}$$

Ans (E)

A particle rotates clockwise with a constant speed in a horizontal circle whose center is at the origin. It completes one revolution in 2.0 s. At t = 0.0, the particle is at (0.0, 1.5) m. What is the magnitude of the average acceleration of the particle in the interval between t = 3.0 and t = 8.0 seconds?

A) 1.9 m/s^2
B) 4.7 m/s^2
C) 0
D) 1.0 m/s^2
E) 0.60 m/s^2



فكرة السؤال أن السرعة عند (t) الزوجية هي نفسها عند t الفردية
ولكنها تختلف في الاتجاه ⟸

$$|a_{avg}|_{3\to 8} = \frac{v_8 - v_3}{8-3} = \frac{\left[\frac{2\pi r}{T} - -\frac{2\pi r}{T}\right]}{5}$$

$$= \frac{4}{5}\frac{\pi r}{T} = \frac{0.8\,\pi\,(1.5)}{2} = 1.88 \simeq 1.9 \text{ m/s}^2$$

A ball is thrown straight upward and returns to the thrower's hand (at the same initial level) after 3.00 s. A second ball thrown from the same height at an angle of 37.0° with the horizontal reaches the same maximum height as the first ball. With what speed was the second ball thrown?

A) 24.4 m/s
B) 14.7 m/s
C) 29.1 m/s
D) 49.3 m/s
E) 35.2 m/s

للكرة الأولى بدأ من أعلى الصعود = $\frac{3}{2}$
وهو نفس زمن الصعود للكرة الثانية

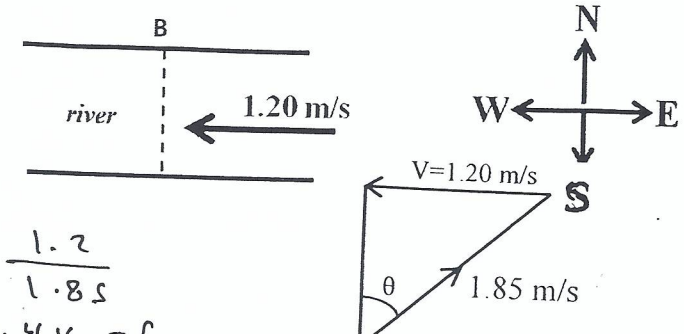
$$\frac{3}{2} = \frac{V_0 \sin 37}{g}$$

$$V_0 = \frac{1.5\,(9.8)}{\sin 37} = 24.43 \text{ m/s}$$

A boat is to travel from point A to point B directly across a river. The water in the river flows with a velocity of 1.20 m/s toward the west, as shown in **Figure 3**. If the speed of the boat in still water is 1.85 m/s, at what angle from the north must the boat head?

A) 40.4° east of north
B) 30.2° west of north
C) 10.5° east of north
D) 90.0° west of north
E) 55.0° west of north

Figure # 3



$$\sin\theta = \frac{1.2}{1.85}$$

$$\Rightarrow \theta = 40.4°$$

Figure 3 shows three paths for a soccer ball kicked from ground level. Rank the paths according to the time of flight, greatest first. Ignore the effects of air.

A) All tie
B) Path 1, Path 2, Path 3
C) Path 3, Path 2, Path 1
D) Path 2, Path 1, Path 3
E) Path 2, Path 3, Path 1

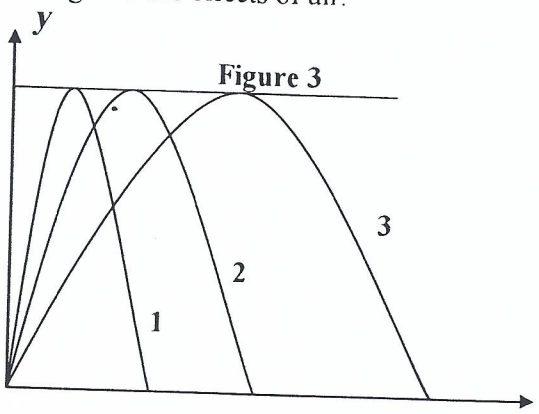


Figure 3

في الثلاث مسارات بدأ الارتفاع نفسه لذلك يكون الزمن متساوي

Figure 4 shows three situations in which identical projectiles are launched (at the same level) at identical initial speeds and angles. The projectiles do not land on the same surface, however. Rank the situations according to the final speeds of the projectiles just before they land, greatest first.

A) a; b; c
B) a; c; b
C) b; a; c
D) b; c; a
E) c; a; b

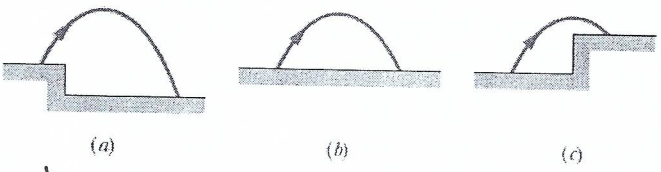


Figure 4

لا خطأ ـ مقدار السرعة عندما نقطة يتوقف على مقدار V_y

$V_{y_a} > V_{y_b} > V_{y_c}$ لذلك V_x ـ ثابتة

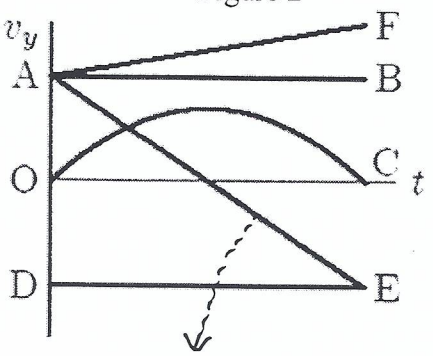
A student throws a red ball from the balcony of a tall building with an initial horizontal speed of 10 m/s. At the same time, a second student drops a blue ball from the same balcony. Neglecting air resistance, which statement is true?

A) The two balls reach the ground at the same instant.
B) The blue ball reaches the ground first.
C) The red ball reaches the ground first.
D) Both balls hit the ground with the same speed.
E) The blue ball hits the ground with larger speed.

تعامل الحالة هنا كأنها سقوط حر وبما أنه يسقط من نفس الارتفاع ، لذلك يتساوى زمن السقوط

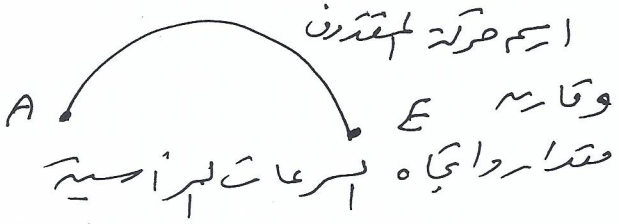
Which one of the curves shown in **Figure 2** best represents the vertical component of the velocity v_y versus time t for a projectile fired at an angle of 45^0 above the horizontal?

Figure 2



A) AE ✓
B) AB
C) OC
D) DE
E) AF

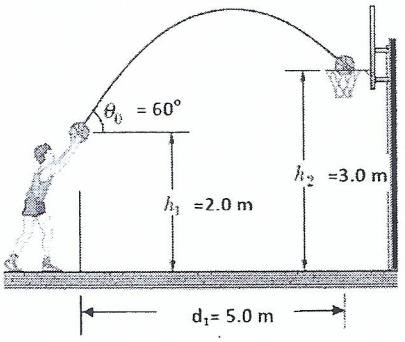
$V_{Ay} = -V_{Ey}$



اسم حركة المقذوف
وقاسم E
مقدار واتجاه السرعات لحظية

A basketball player would like to throw a ball at an angle of $\theta_0 = 60°$ above the horizontal such that the ball just goes through the center of the rim of the basket that is $h_2 = 3.0$ m high from the floor and it is at a horizontal distance of $d_1 = 5.0$ m from the player's hand (see **Figure 3**). At the instant the ball leaves the player's hand, his hand is $h_1 = 2.0$ m above the floor. Find the magnitude of the initial velocity of the ball.

Figure 3



A) 8.0 m/s
B) 5.0 m/s
C) 9.8 m/s
D) 3.2 m/s
E) 7.0 m/s

$\Longrightarrow d = v_x t$

$5 = V \cos 60\, t$

$t = \frac{10}{V}$

$\Rightarrow \Delta y = v_{oy} t - \frac{1}{2} g t^2$

$(3-2) = V \sin 60\, t - \frac{1}{2} g t^2$

$1 = \frac{\sqrt{3}}{2} V \left(\frac{10}{V}\right) - \frac{1}{2}(10)\left(\frac{10}{V}\right)^2$ $\boxed{g=10}$ لاحظ

$1 = 5\sqrt{3} - \frac{500}{V^2} \Rightarrow (5\sqrt{3}-1) = \frac{500}{V^2}$

$\boxed{V = 8.08}$ وبحل المعادلة نحصل على

Q10.

The position of a particle is given as $\vec{r} = (4.0t - t^2)\,\hat{i} + t^3\,\hat{j}$ where r is in meters and t is in seconds. The particle's acceleration at $t = 0\ s$ is:

A) $(-2.0\,\hat{i})\ m/s^2$

B) $(-2.0\,\hat{i} + 6.0\,\hat{j})\ m/s^2$

C) $(2.0\,\hat{i} + 3.0\,\hat{j})\ m/s^2$

D) $(6.0\,\hat{j})\ m/s^2$

E) zero

$\vec{r} = (4t - t^2)\,\hat{i} + t^3\,\hat{j}$

$\vec{v} = (4 - 2t)\,\hat{i} + 3t^2\,\hat{j}$

$\vec{a} = (-2)\,\hat{i} + 6t\,\hat{j}$

$a_0 = (-2.0\,i)\ m/s^2$

Q11.

A projectile is fired horizontally at a speed of 15 *m/s* from the top of a tower. It lands on the ground at a horizontal distance of 45 *m*. The height of the tower is:

A) 44 *m*
B) 98 *m*
C) 32 *m*
D) 22 *m*
E) 88 *m*

$\Delta x = v_{0x}\,t$

$45 = 15\,t$

$t = 3\ s$

$\therefore\ \Delta y = v_{0y}\,t - \frac{1}{2}gt^2$

$-h = 0 - \frac{1}{2}(9.8)(9)$

$-h = -44.1$

$h = 44.1$

6

Q12.
If the moon makes a complete circle around the earth in 29 *days* (= 2.5×10^6 *s*) and the distance between the center of earth and the center of the moon is 3.8×10^8 *m*, then the magnitude of centripetal acceleration on the moon is:

A) 2.4×10^{-3} m/s^2
B) 9.8 m/s^2
C) 1.6 m/s^2
D) 1.5×10^2 m/s^2
E) 6.1×10^{-4} m/s^2

$$a = \frac{v^2}{r} = \frac{2^2\pi^2 r^2}{t^2 \cdot r}$$

$$= \frac{4\pi^2 r}{t^2}$$

$$= \frac{4\pi^2 (3.8 \times 10^8)}{(2.5 \times 10^6)^2}$$

$$= 2.4 \times 10^{-3}\ m/s^2$$

Q13.
Two boats *A* and *B* leave seaport at the same time. Boat *A* travels at a speed of 10.0 *m/s* in the +*x* direction and boat *B* heads at an angle of 60.0° with the *x*-axis at a speed of 10.0 *m/s*. The velocity of *A* relative to *B* is

A) $\left(5.00\,\hat{i} - 8.66\,\hat{j}\right)$ *m/s*
B) $\left(20.0\,\hat{i} - 12.7\,\hat{j}\right)$ *m/s*
C) $\left(36.0\,\hat{i} - 12.7\,\hat{j}\right)$ *m/s*
D) $\left(22.3\,\hat{i} - 12.7\,\hat{j}\right)$ *m/s*
E) $\left(5.00\,\hat{i} - 22.3\,\hat{j}\right)$ *m/s*

$$\vec{V_A} = 10\hat{i}\ m/s \quad , V_B = (10\cos 60)\hat{i} + (10\sin 60)\hat{j}$$

$$= 5\hat{i} + 8.66\hat{j}$$

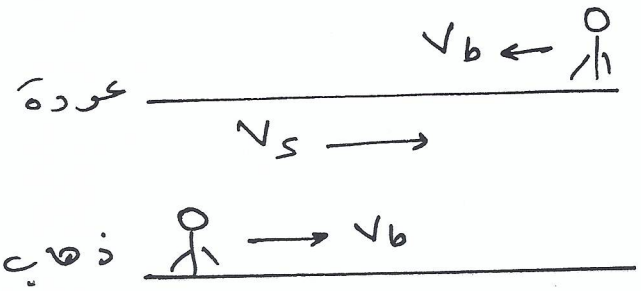
$$\therefore \vec{V_{AB}} = \vec{V_A} - \vec{V_B}$$

$$= (10 - 5)\hat{i} + (0 - 8.66)\hat{j}$$

Q10.

082 The airport terminal in Dammam has a 100 m "moving sidewalk" that moves at a constant speed of 1.00 m/s. A boy boards the moving sidewalk and walks on it with a speed of 2.00 m/s to make a round trip. How long does it take this boy to make the round trip on the moving sidewalk?

A) 133 s
B) 331 s
C) 200 s
D) 419 s
E) 255 s



Velocity of sidewalk $v_s = 1$ m/s

" " a boy $v_b = \pm 2$ m/s

$X = v_{tot}\, t$ نعوض في المعادلة

أثناء الذهاب ثم أثناء العودة

أثناء الذهاب $100 = (1+2)\, t_1$

$\Rightarrow t_1 = \frac{100}{3} = 33$ s

أثناء العودة $100 = (2-1)\, t_2$

$t_2 = 100$

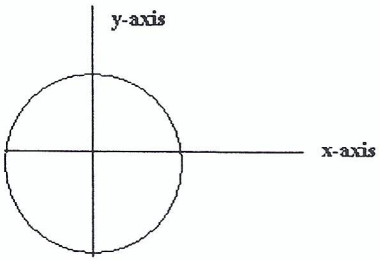
Total time $= t_1 + t_2$

$= 33 + 100$

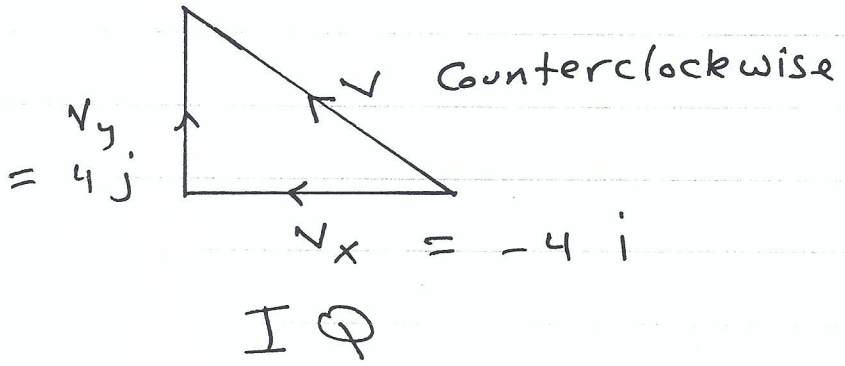
$= 133$ s

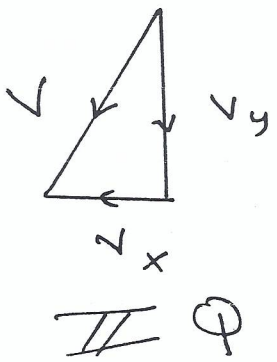
Q11.

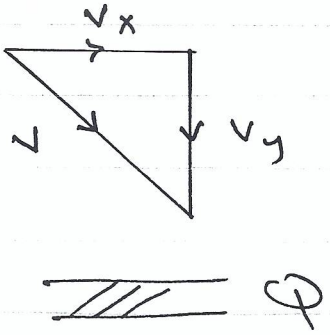
Fig. 2 shows a circular path taken by a particle. If the instantaneous velocity of the particle is $\mathbf{v} = -(4.0\ \text{m/s})\,\mathbf{i} + (4.0\ \text{m/s})\,\mathbf{j}$, through which quadrant is the particle moving at that instant if it is traveling counterclockwise?

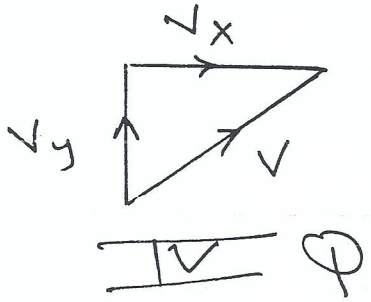


A) First quadrant
B) Third quadrant.
C) Second quadrant
D) Fourth quadrant
E) None of the quadrants









Ch 4
3

Q12.
A particle leaves the origin with an initial velocity **v** = (3.00 **i**+ 4.00 **j**) m/s and has a constant acceleration **a** = (-1.00 **i** - 0.400 **j**) m/s^2. What is its position vector when it reaches its maximum x coordinate?

A) (4.50 **i** + 10.2 **j**) m
B) (4.50 **i**) m
C) (10.2 **j**) m
D) (4.50 **i** - 10.2 **j**) m
E) (10.2 **i** + 4.50 **j**) m

At maximum x coordinate

$v_x = 0$

$v_x = v_{0x} + a_x t$

$0 = 3i - (1)i\,t$

$t = 3\ s$

$\Rightarrow$

$\vec{\Delta r} = \vec{v}_i t + \frac{1}{2}\vec{a}t^2$

$= 3(3i + 4j) + \frac{1}{2}(-i - 0.4j)(9)$

$= 9i + 12j - \frac{9}{2}i - 1.8j$

$= 4.5i + 10.2j$

Q14.
A meter stick is rotating about one end and completes 500 revolutions every minute. Find the speed and acceleration of its tip (the other end).

A) 52.4 m/s; 2.74 x 10^3 m/s^2
B) 25.4 m/s; 27.4 x 10^1 m/s^2
C) 5.24 m/s; 15.5 x 10^3 m/s^2
D) 10.0 m/s; 7.34 x 10^3 m/s^2
E) 1.50 m/s; 5.50 x 10^3 m/s^2

ch4
4

$V = \omega r$ $\quad r = 1\ m$

$V = \dfrac{(500)(2\pi)(1)}{60}$

$= 52.33\ m/s$

$a = \dfrac{V^2}{r}$

$= \dfrac{(52.33)^2}{1}$

$= 2.738 \times 10^3\ m/s^2$

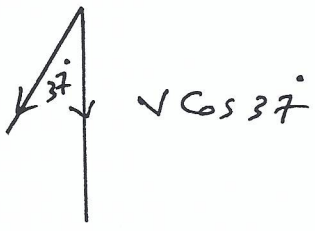
Q13.
A plane, diving with constant speed at an angle of 37.0 degrees with the vertical, releases a package at a height of 950 m. The package hits the ground 6.00 s after release. Find the speed of the plane.

A) 161 m/s
B) 200 m/s
C) 103 m/s
D) 302 m/s
E) 98.0 m/s

$V_{0y} = V \cos 37$

$\Delta y = -950$

$g = 9.8$



$\Delta y = V_{0y} t - \frac{1}{2} g t^2$

$-950 = 6V \cos 37^\circ - \frac{1}{2}(9.8)(36)$

$V = 161.44\ m/s$

ch 4
5

Q11.

A particle is moving in the xy-plane with a constant acceleration $\vec{a} = -1.0\,\hat{i} - 0.50\,\hat{j}$ (m/s^2). It leaves the origin with an initial velocity $3.0\,\hat{i}$ (m/s). What is the velocity in m/s of the particle when it reaches its maximum x coordinate?

A) $-1.5\,\hat{j}$
B) zero
C) $+1.5\,\hat{j}$
D) $-1.5\,\hat{i}$
E) $+1.5\,\hat{i}$

At maximum x coordinate

$$v_x = 0$$

$$v_x = v_{0x} + a_x t$$

$$0 = 3i + -it$$

$$t = 3\ s$$

$$\Rightarrow \quad v_y = v_{0y} + a_y t$$

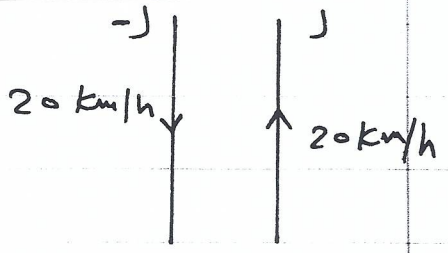
$$= 0 + -0.5(3)j$$

$$= -1.5j$$

Q12.

A car is moving north at 20 km/h. It makes a gradual 180° turn (U-turn) at the same speed, changing its direction of travel from north to south in 20 s. The average acceleration of the car for this turn is:

A) 2.0 km/h·s, toward the south
B) 1.0 km/h·s, toward the south
C) 1.0 km/h·s, toward the north
D) 2.0 km/h·s, toward the north
E) zero



$$a = \frac{v_f - v_i}{t}$$

$$= \frac{-20j - 20j}{20}$$

$$= -2\ km/h \cdot s$$

Ch 9
6

Q14.
In figure 5, a particle P is in uniform circular motion, centered at the origin of an xy coordinate system. At what point shown in the figure is the magnitude of the particle's vertical acceleration a_y maximum?

A) A
B) B
C) C
D) D
E) E

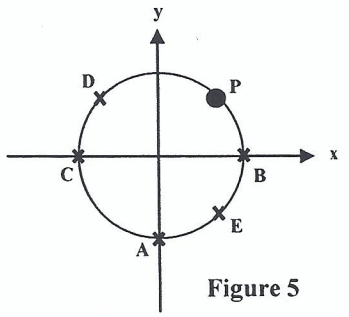


Figure 5

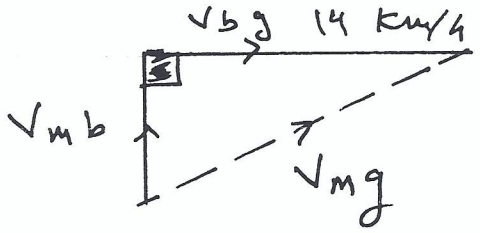
At point A ⟹

$a_x = 0$

a_y is maximum

Q13.
A boat is traveling at 14 km/h in still water (water is not flowing). A man runs directly across the boat, from one side to the other (perpendicular to the direction of motion of the boat), at 6 km/h relative to the boat. The speed of the man relative to the ground is:

A) 15 km/h
B) 13 km/h
C) 14 km/h
D) 8.0 km/h
E) 20 km/h



$\vec{V}_{mb} + \vec{V}_{bg} = \vec{V}_{mg}$

$V_{mg} = \sqrt{6^2 + 14^2}$

$= 15.23 \text{ km/h}$

Q11.
A straight river has a steady speed of 0.5 m/s. A boy swims upstream a distance of 500 m and swims back to the starting point. If the boy can swim at a speed of 1.5 m/s in still water, calculate the total time taken for his round trip?

A) 750 s
B) 667 s
C) 500 s
D) 1000 s
E) 2000 s

$X = vt$

upstream

$\rightarrow 0$

$\rightarrow v_b = 1.5$ m/s

$500 = (1.5 - 0.5)\, t_1$

$t_1 = 500$ s

downstream

$500 = (1.5 + 0.5)\, t_2$

$t_2 = \frac{500}{2}$

$= 250$ s

$t_{total} = t_1 + t_2 = 250 + 500 = 750$ s

Q10.
A particle is moving in the horizontal *xy*-plane with a constant acceleration. If it starts from the origin with an initial velocity $\vec{v}_0 = 4\hat{i} + 4\hat{j}$ m/s, and 2 seconds later reaches the position $4\hat{i} + 5\hat{j}$ m, find its velocity at time $t = 2$ s.

A) $1\hat{j}$ m/s
B) $8\hat{i} + 9\hat{j}$ m/s
C) $9\hat{i} + 8\hat{j}$ m/s
D) $4\hat{i} + 6\hat{j}$ m/s
E) $3\hat{i} + 2\hat{j}$ m/s

$\vec{v}_i = 4i + 4j$

$\vec{\Delta r} = 4i + 5j$

$t = 2$ s

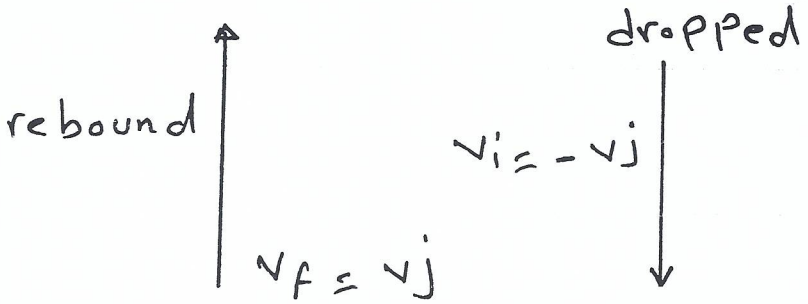
$$\vec{\Delta r} = \vec{v_i} t + \frac{1}{2}\vec{a} t^2$$

$$4i + 5j = 2(4i + 4j) + \frac{1}{2}\vec{a}(4)$$
$$4i + 5j = 8i + 8j + 2\vec{a}$$
$$-4i - 3j = 2\vec{a}$$
$$-2i - \frac{3}{2}j = \vec{a}$$

$$\vec{v} = \vec{v_i} + \vec{a} t$$
$$= 4i + 4j + (-2i - 1.5j)(2)$$
$$= 4i + 4j - 4i - 3j$$
$$= j$$

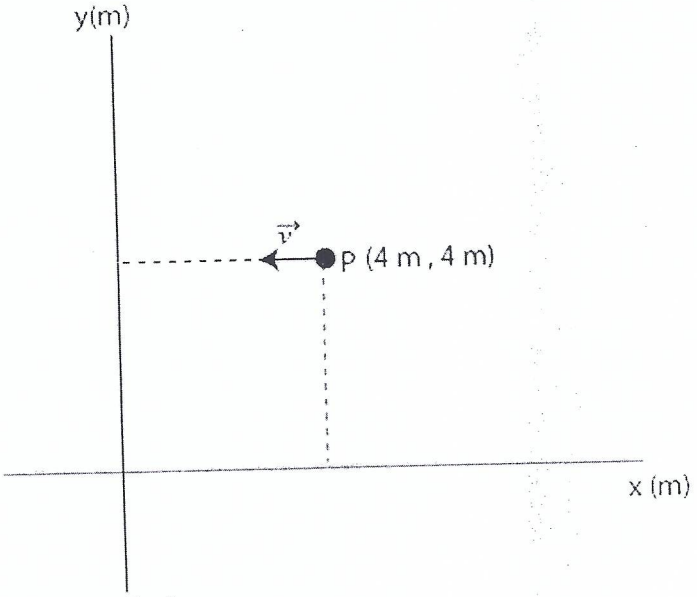
Q3.
A ball is dropped (free fall) from a certain height. The ball hits the ground with speed v and rebounds vertically upward with the same speed v. What is the change in velocity of the ball during impact with the ground ($\hat{j}$ is a unit vector along the positive y-axis)? Neglect air resistance.

A) $+2v\ \hat{j}$
B) $-2v\ \hat{j}$
C) $+v\ \hat{j}$
D) $-v\ \hat{j}$
E) 0



$$\Delta v = v_f - v_i$$
$$= vj - -vj$$
$$= 2vj$$

Q12.
A particle moves horizontally in uniform circular motion in a horizontal xy plane. At one instant it moves through the point P at coordinates (4 m, 4 m) with a velocity of $-6\,\hat{i}$ m/s and an acceleration of $12\,\hat{j}$ m/s^2 where $\hat{i}$ and $\hat{j}$ are unit vectors along x and y axes, respectively (**Figure 3**). Find the x and y coordinates of the center of the circular path.

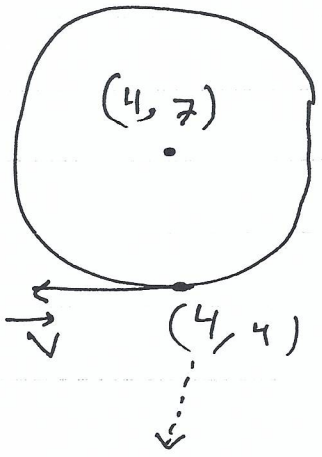


A) (4 m, 7 m)
B) (4 m, 6 m)
C) (7 m, 7 m)
D) (6 m, 4 m)
E) (0 m, 0 m)

$$a = \frac{v^2}{r}$$

$$12 = \frac{6^2}{r}$$

$$r = 3 \text{ m}$$



The lowest point

9
10

Q13.
While flying horizontally at a constant velocity a plane drops a package through a trap door in its floor. The plane continues at the same velocity. At the instant the package strikes the ground, neglecting air friction, the plane will be (Choose the CORRECT answer):

✓A) Directly over the package.
B) Far behind the package.
C) In front of the package.
D) Just behind the package.
E) At a relative position which depends on the plane's speed.

according to the Constant and horizontaly velocity, so the backage gains the same velocity as the plane. «V_x is constant for both»

Q11.
At $t = 0$, a particle is moving in the x-y plane with a velocity of $(5.0\,\hat{j})$ m/s and a constant acceleration of $(2.0\,\hat{i} + 3.0\,\hat{j})$ m/s^2. Find the velocity of the particle at $t = 5.0$ s.

A) $(10\,\hat{i} + 20\,\hat{j})$ m/s
B) $(10\,\hat{i} + 5.0\,\hat{j})$ m/s
C) $(5.0\,\hat{i} + 10\,\hat{j})$ m/s
D) $(20\,\hat{i} + 12\,\hat{j})$ m/s
E) $(15\,\hat{i} + 15\,\hat{j})$ m/s

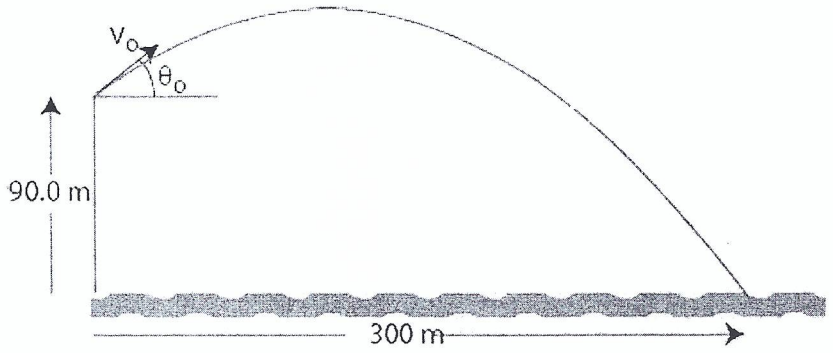
$V_i = 5j$ m/s
$a = 2i + 3j$
$t = 5$

$V = V_i + at \Rightarrow V = 5j + (2i+3j)(5)$
$= 5j + 10i + 15j$

Q13.

A ball is thrown from the top of a cliff as shown in **Figure 2**. The ball lands 10.0 seconds later in water 300 m from the base of the cliff. The height of the cliff is 90.0 m. Neglect the air resistance and find the initial speed v_o of the ball.

Fig#



A) 50.0 m/s
B) 40.6 m/s
C) 60.5 m/s
D) 90.0 m/s
E) 30.4 m/s

$\Delta y = -90\ m$

$g = -9.8\ m/s^2$

$t = 10\ s$

$\Delta y = V_{oy} - \frac{1}{2} g t^2$

$-90 = V_{oy} - \frac{1}{2}(9.8)(10)^2$

$-90 = V_{oy} - 490$

$400 = V_{oy}$

$X = V_{ox}\, t$

$300 = 10 V_{ox}$

$30 = V_{ox}$

$\text{speed} = \sqrt{V_{ox}^2 + V_{oy}^2} = \sqrt{30^2 + 40^2}$

$= 50\ m/s$