Name KEY

Exam 1 24 questions

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) While a car travels around a circular track at a constant speed its Velocity vector is changing direction.

A) acceleration is zero.

B) inertia is zero.

C) velocity is zero.

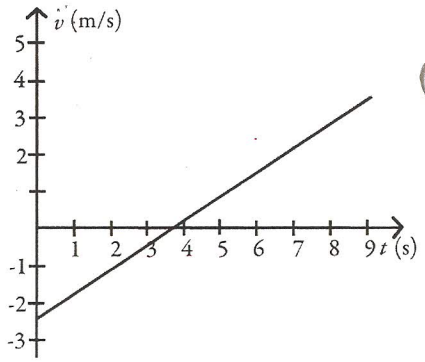
D) none of the above

don't yet know what this is.

"best" answer

2) The motion of a particle is described in the velocity versus time graph shown in the figure. We can say that its acceleration _____.

$a \equiv \frac{dv}{dt}$



constant, positive slope

A) decreases and then increases.

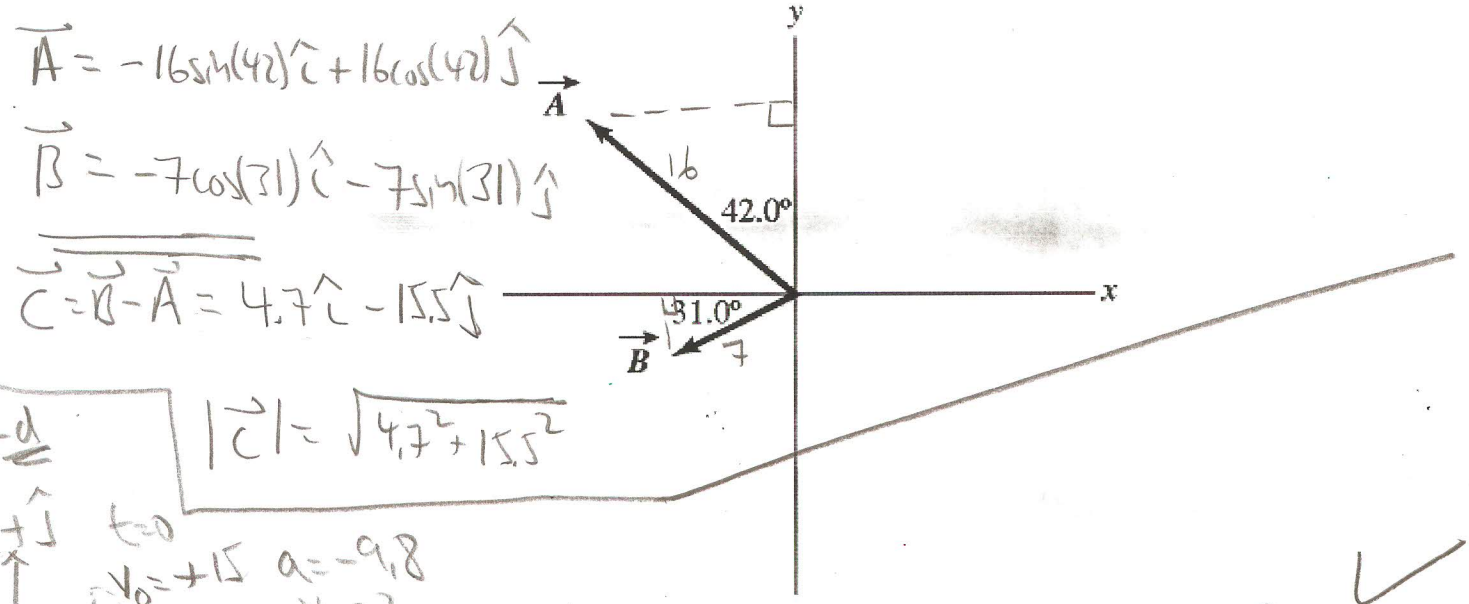
B) increases.

C) is constant

D) increases and then decreases.

OVER →

3) Vectors $\vec{A}$ and $\vec{B}$ are shown in the figure. Vector $\vec{C}$ is given by $\vec{C} = \vec{B} - \vec{A}$. The magnitude of vector $\vec{A}$ is 16.0 units, and the magnitude of vector $\vec{B}$ is 7.00 units. What is the magnitude of vector $\vec{C}$?



$\vec{A} = -16\sin(42)\hat{i} + 16\cos(42)\hat{j}$

$\vec{B} = -7\cos(31)\hat{i} - 7\sin(31)\hat{j}$

$\vec{C} = \vec{B} - \vec{A} = 4.7\hat{i} - 15.5\hat{j}$

$|\vec{C}| = \sqrt{4.7^2 + 15.5^2}$

A) 17.5 B) 15.5 C) 9.53 D) 9.00 (E) 16.2

4) A package is dropped from a helicopter moving upward at 15 m/s. If it takes 16.0 s before the package strikes the ground, how high above the ground was the package when it was released?

(A) 1000 m B) 1200 m C) 810 m D) 1500 m

(1) $y(t) = y_0 + 15t - 4.9t^2$ | @ $t = t_{hit} = 16$, $y_{hit} = 0$

So we have $0 = y_0 + 15(16) - 4.9(16)^2$

$y_0 = 1014$

5) While an object near the earth's surface is in free fall, its _____.

A) acceleration increases. (B) velocity increases.

C) mass increases. D) mass decreases.

$9.8\ m/s^2$

$\vec{v}$ in same direction as $\vec{a}$

6) Object A has a position as a function of time given by $\vec{r}_A(t) = 3.00\,t\,\hat{i} + 1.00\,t^2\,\hat{j}$. Object B has a position as a function of time given by $\vec{r}_B(t) = 4.00\,t\,\hat{i} - 1.00\,t^2\,\hat{j}$. All quantities are SI units. What is the distance between object A and object B at time $t = 3.00$ s? (D)

A) 34.6 m (B) 18.2 m C) 29.8 m D) 15.0 m E) 3.46 m

$\vec{r}_A(t=3) = 9\hat{i} + 9\hat{j}$

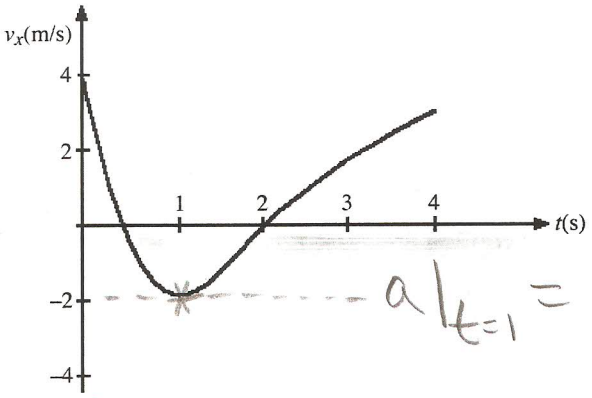
$\vec{r}_B(t=3) = 12\hat{i} - 9\hat{j}$

$\vec{D}_{t=3} = \vec{r}_A(t=3) - \vec{r}_B(t=3) = -3\hat{i} + 18\hat{j}$

$|\vec{D}_{t=3}| = \sqrt{3^2 + 18^2} = 18.2$

7) The figure represents the velocity of a particle as it travels along the x-axis. At what value (or values) of t is the instantaneous acceleration equal to zero?

$a = \frac{dv}{dt}$



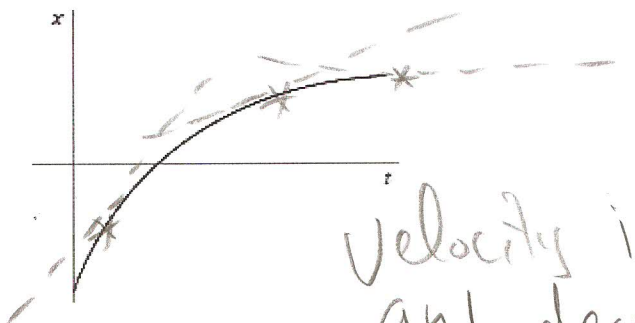
A) $t = 0$

B) $t = 0.5$ s and $t = 2$ s

C) $t = 1$ s ✓

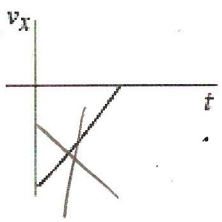
8) The figure shows the graph of the position x as a function of time for an object moving in the straight line along the x-axis. Which of the following graphs best describes the velocity along the x-axis as a function of time for this object?

$v = \frac{dx}{dt}$

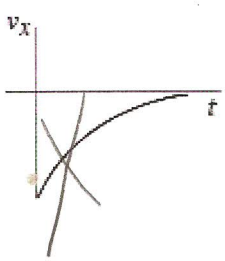


velocity is positive and decreases to zero.

A)

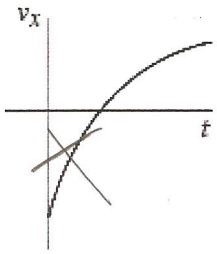


B)

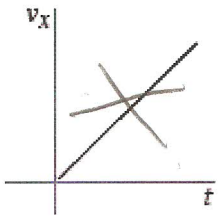


OVER → for (C), (D), and (E)

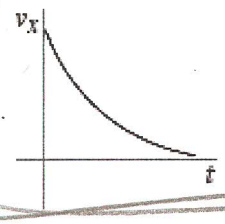
C)



D)



(E)



only option.

$a(t) = \frac{dv}{dt} = 3 - 2t$

$\therefore a(t=5) = 3 - 10 = -7$

9) The velocity of an object as a function of time, in meters and seconds, is given by $v(t) = 2.00 + 3.00\,t - t^2$. Determine the instantaneous acceleration of the object at time $t = 5.00$ s.

(A) -7.00 m/s^2 B) 0.00 m/s^2 C) -8.00 m/s^2 D) -2.00 m/s^2 E) 2.00 m/s^2

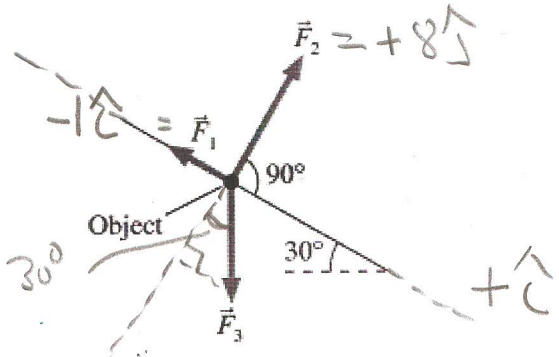
10) If $\vec{A} = +4\,\hat{i} - 2\,\hat{j} - 3\,\hat{k}$ and $\vec{C} = -4\,\hat{i} - 2\,\hat{j} - 3\,\hat{k}$, which of the following numbers is closest to the magnitude of $\vec{A} - \vec{C}$?

A) 10 B) 7 C) 9 (D) 8 E) 11

$(\vec{A} - \vec{C}) = 8\hat{i} + 0\hat{j} + 0\hat{k}$

OVER →

11) Three forces are exerted on an object placed on a tilted floor. Forces are vectors. The three forces are directed as shown in the figure. If the forces have magnitudes $F_1 = 1.0$ N, $F_2 = 8.0$ N and $F_3 = 7.0$ N, where N is the standard unit of force, what is the component of the *net force* $\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$ parallel to the floor? Report your answer as a positive number.



A) 2.5 N B) 7.8 N C) 6.0 N D) 5.1 N

12) A bullet is fired straight down from the top of a high cliff. Neglecting air resistance, the acceleration of the bullet after it has left the gun _____.

A) is less than 9.8m/s^2.
B) is more than 9.8m/s^2.
C) is 9.8 m/s^2.
D) depends on the height of the cliff.

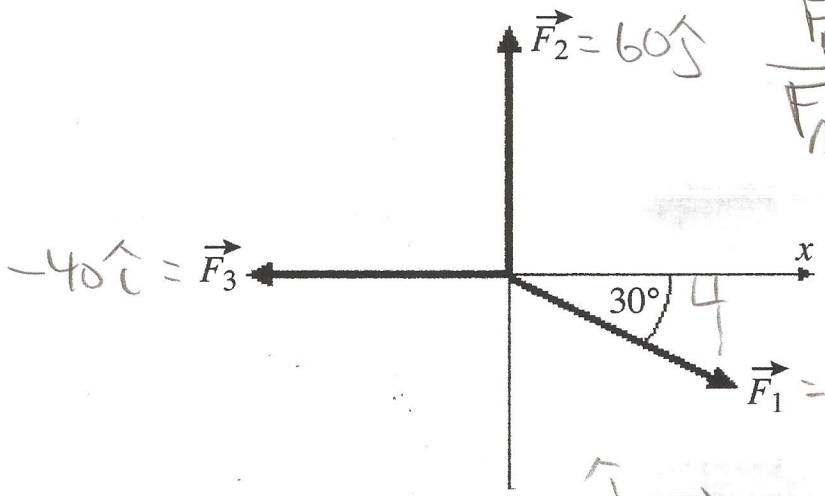
13) A rock is thrown at an angle of 50 degrees with respect to the horizontal. When the rock is at the highest point of its trajectory, _____.

A) its velocity and acceleration are both zero.
B) the horizontal and vertical components of its velocity are zero.
C) its acceleration is zero.
D) its velocity is perpendicular to the acceleration.
E) the horizontal component of its velocity is zero.

14) Suppose that a car traveling in the $-x$ direction begins to slow down as it approaches a traffic light. Which statement is correct?

A) Its acceleration is positive but its velocity is negative.
B) Both its acceleration and its velocity are negative.
C) Its acceleration is negative but its velocity is positive.
D) Both its acceleration and its velocity are positive.

15) As shown in the figure, three force vectors act on an object. The magnitudes of the forces as shown in the figure are $F_1 = 80.0$ N, $F_2 = 60.0$ N, and $F_3 = 40.0$ N, where N is the standard SI unit of force. The resultant force acting on the object is given by

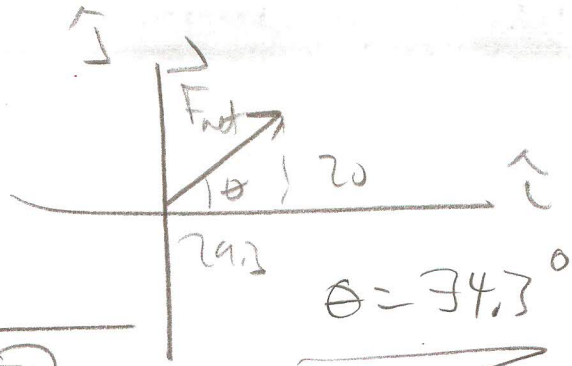


$\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$

$\vec{F}_{net} = 29.3\hat{i} + 20\hat{j}$

$|\vec{F}_{net}| = 35.5$

A) 35.5 N at an angle 34.3° with respect to +x-axis.
B) 20.0 N at an angle 34.3° with respect to +x-axis.
C) 180 N at an angle 60.0° with respect to +x-axis.
D) 40.0 N at an angle 60.0° with respect to +x-axis.
E) 60.0 N at an angle 90.0° with respect to +x-axis.



$\theta = 34.3°$

Subtle. An "A" question

16) Alice and Tom dive from an overhang into the lake below. Tom simply drops straight down from the edge, but Alice takes a running start and jumps with an initial horizontal velocity of 25 m/s. Neither person experiences any significant air resistance. Just as they reach the lake below _____.
HINT: Recall that 'speed' is the magnitude of the velocity vector.

ALWAYS TRUE

A) the speed of Tom will always be 9.8 m/s larger than that of Alice.
B) the speed of Alice is larger than that of Tom. "best" answer
C) they will both have the same speed.
D) the splashdown speed of Alice is larger than that of Tom.
E) the speed of Alice will always be 25 m/s larger than that of Tom.

TRUE BUT

$|\vec{v}| = \sqrt{v_x^2 + v_y^2}$

The vertical components of their velocities will ALWAYS be IDENTICAL.
Alice will have a horizontal component while Tom will NOT.

17) A ball is thrown upward, at time $t = 0.0$ s, from a point on a roof 90 m above the ground. The ball rises, then falls and strikes the ground. The initial velocity of the ball is 36.2 m/s. Ignoring air resistance, find the time when the ball strikes the ground.

A) 9.4 s ✓ B) 9.7 s C) 8.7 s D) 10 s E) 9.0 s

$\uparrow = d$

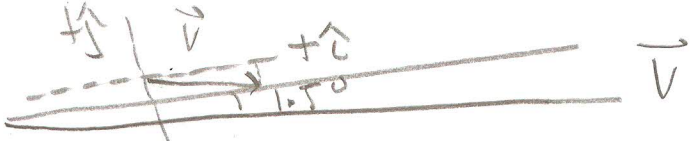
$v_0 = +36.2, y_0 = 90$

$y(t) = 90 + 36.2t - 4.9t^2$ [1]

@ $t = t_{hit}, y_{hit} = 0$

[1] $\Rightarrow 0 = 90 + 36.2t_{hit} - 4.9t_{hit}^2$

$\therefore t_{hit} = \frac{-36.2 \pm \sqrt{36.2^2 + 4(4.9)90}}{-9.8}$



18) A helicopter is flying horizontally, in the +x direction, with a speed of 444 m/s over a hill that slopes upward at an angle of 1.15 degress with respect ot the horizontal (the +x axis). What is the magnitude of the component of the helicopter's velocity that is perpendicular to the sloping surface of the hill?

A) 8.9 m/s B) 435 m/s C) 220 m/s D) 444 m/s

$\vec{V} = +444\cos(1.15)\hat{i} - 444\sin(1.15)\hat{j}$

19) A car accelerates from 10.0 m/s to 30.0 m/s at a constant rate of 3.00 m/s^2. How far does the car travel while accelerating?

A) 226 m B) 399 m C) 133 m D) 80.0 m

$a=+3$ | $t=0$, $x_0=0$, $v_0=10$ | $t=t_1$, $v_1=30$ | $+\hat{i}$ | (1) $x(t) = 10t + 1.5t^2$ | (2) $v(t) = 10 + 3t$ | @ $t=t_1$, $v_1=30$ | (2) $\Rightarrow 30 = 10 + 3t_1$ | $\therefore t_1 = 6.67$ | (1) $\Rightarrow x_1 = 10t_1 + 1.5t_1^2 = 133$

20) A monkey is sitting at the top of a tree 20 m above ground level. A person standing on the ground wants to feed the monkey. He uses a bow and arrow to launch the food to the monkey. If the person knows that the monkey is going to drop from the tree at the same instant that the person launches the food, how should the person aim the arrow containing the food? Air resistance is small enough to be ignored and we asume that the monkey lets go at the instant the arrow is shot.

A) He should aim it above the monkey.

B) He should aim it below the monkey.

C) He should aim it at the monkey. from class

21) A ball tossed vertically upward rises, reaches its highest point, and then falls back to its starting point. During this time the acceleration of the ball is always _____.

A) opposite its velocity. B) directed upward.

C) directed downward. D) in the direction of motion.

in the direction of the force (which is constant)

22) A heavy object and a light object are dropped at the same time from rest in a vacuum. The heavier object reaches the ground _____.

A) at the same time as the lighter object. B) later than the lighter object.

C) sooner than the lighter object. D) almost immediately

→ None of our eqns have mass. Feather & Ball from class

23) An object has a position given by $\vec{r} = [2.0 + 5.00\,t]\,\hat{i} + [3.0 - 2.00\,t^2]\,\hat{j}$, where quantities are in SI units. What is the speed of the object at time $t = 2.00$ s?

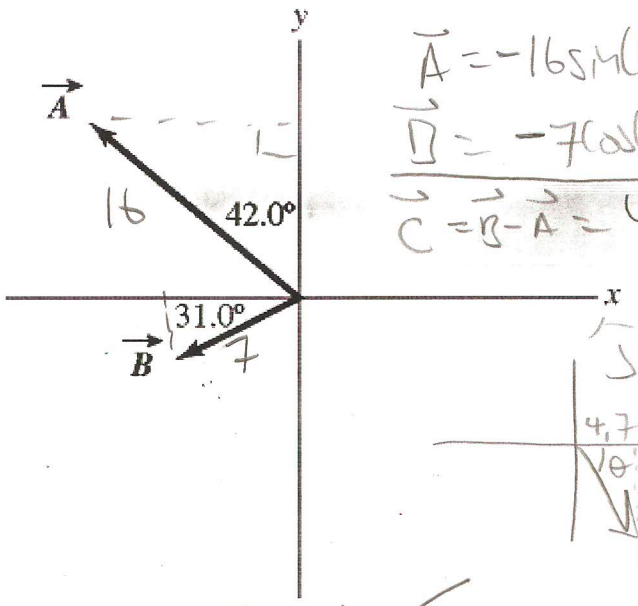
A) 6.40 m/s B) 7.65 m/s C) 7.00 m/s D) 13.0 m/s E) 9.43 m/s

$\vec{V}(t) = \frac{d\vec{r}(t)}{dt} = 5\hat{i} - 4t\hat{j}$

$\vec{V}|_{t=2} = 5\hat{i} - 8\hat{j}$ | $|\vec{V}|_{t=2}| = \sqrt{5^2 + 8^2}$

OVER

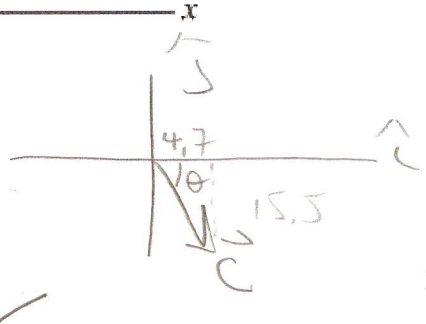
24) Vectors $\vec{A}$ and $\vec{B}$ are shown in the figure. Vector $\vec{C}$ is given by $\vec{C} = \vec{B} - \vec{A}$. The magnitude of vector $\vec{A}$ is 16.0 units, and the magnitude of vector $\vec{B}$ is 7.00 units. What is the angle of vector $\vec{C}$, measured counterclockwise from the $+x$-axis?



$\vec{A} = -16\sin(42)\hat{i} + 16\cos(42)\hat{j}$

$\vec{B} = -7\cos(31)\hat{i} - 7\sin(31)\hat{j}$

$\vec{C} = \vec{B} - \vec{A} = 4.7\hat{i} - 15.5\hat{j}$



A) 16.9° B) 292° C) 287° D) 22.4° E) 73.1°

$\theta = \tan^{-1}\left(\frac{15.5}{4.7}\right) = 73^\circ$

∴ from $+\hat{i}$ axis is -73° or $+287^\circ$