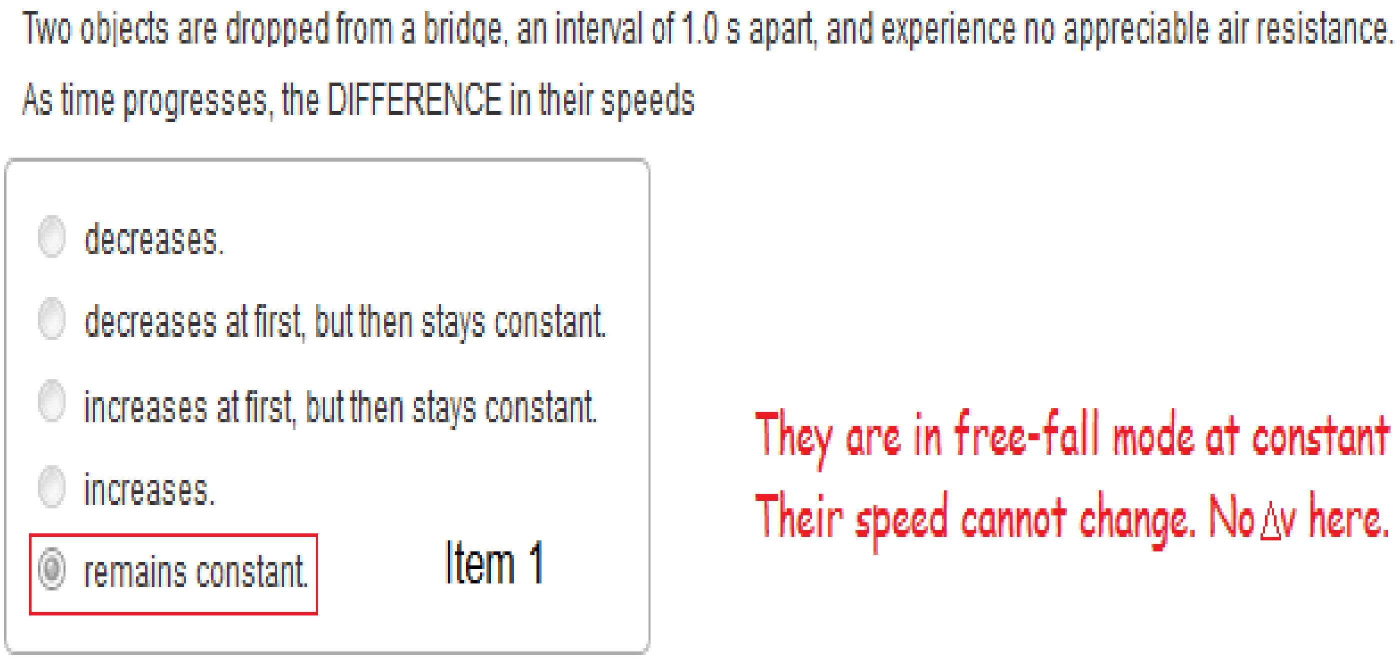
Test 2

Corrected



Two objects are dropped from a bridge, an interval of 1.0 s apart, and experience no appreciable air resistance.

As time progresses, the DIFFERENCE in their speeds

○ decreases.

○ decreases at first, but then stays constant.

○ increases at first, but then stays constant.

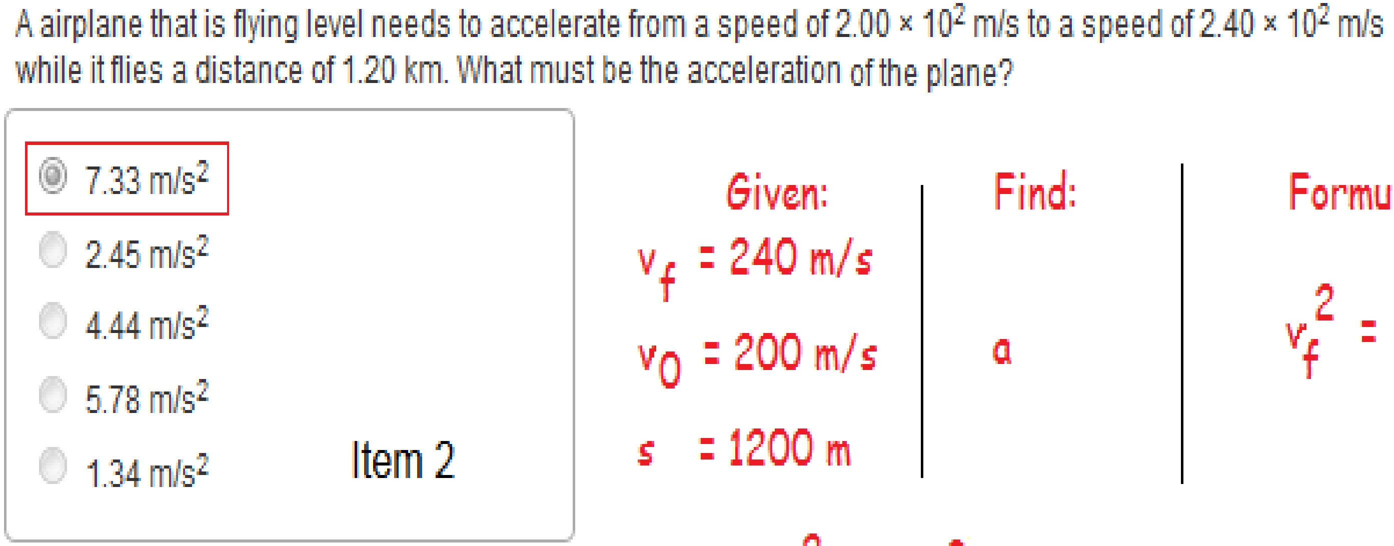
○ increases.

● remains constant.

Item 1

They are in free-fall mode at constant $g = 9.8 m/s^2$

Their speed cannot change. No Δv here.



A airplane that is flying level needs to accelerate from a speed of 2.00 × 10^2 m/s to a speed of 2.40 × 10^2 m/s while it flies a distance of 1.20 km. What must be the acceleration of the plane?

- ● 7.33 m/s^2
- ○ 2.45 m/s^2
- ○ 4.44 m/s^2
- ○ 5.78 m/s^2
- ○ 1.34 m/s^2

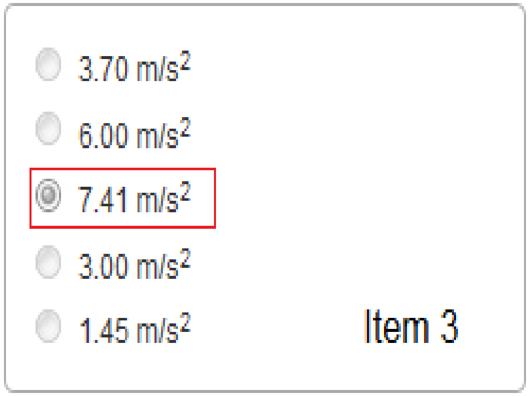
Item 2

Given:	Find:	Formulae:
v_f = 240 m/s		$v_f^2 = v_0^2 + 2as$
v_0 = 200 m/s	a	
s = 1200 m		

$$a = (240^2 - 200^2) / (2 \cdot 1200)$$

$$a = 7.33\ m/s^2$$

A speeding car is traveling at a constant 30.0 m/s when it passes a stationary police car.
If the police car delays for 1.00 s before starting, what must be the magnitude of the
constant acceleration of the police car to catch the speeding car after the police car travels a distance of 300 m?



○ 3.70 m/s^2

○ 6.00 m/s^2

● 7.41 m/s^2

○ 3.00 m/s^2

○ 1.45 m/s^2

Item 3

Given:	Find:	Formulae:
$v_f = 30$ m/s		
$t_d = 1.0$ s	a	$d = (v . t) + [(1/2) \cdot a \cdot t^2]$
$s = 300$ m		$(v . t) = 0$ since the police car was at rest

$t = (300 \text{ m}) / (30 \text{ m/s}) = 10\text{s}$

the police car delays for 1.00 s before starting,

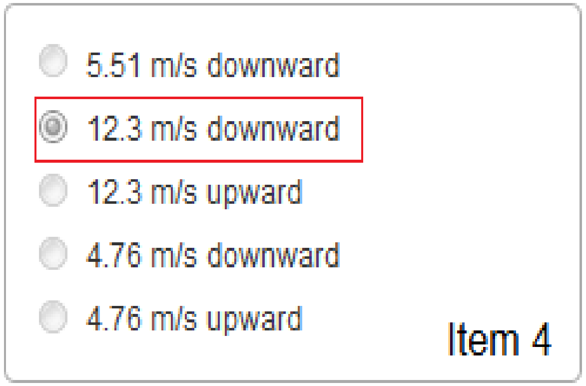
$t = (10 \text{ s} - 1 \text{ s}) = 9 \text{ s}$

$a = 2 \cdot d / (t^2)$

$a = (2 \times 300) / (9^2)$

$a = 7.41 \text{ m/s}^2$

A rock is dropped from the top of a vertical cliff and takes 3.00 s to reach the ground below the cliff. A second rock is thrown vertically from the cliff, and it takes this rock 2.00 s to reach the ground below the cliff from the time it is released. With what velocity was the second rock thrown, assuming no air resistance?



○ 5.51 m/s downward
● 12.3 m/s downward
○ 12.3 m/s upward
○ 4.76 m/s downward
○ 4.76 m/s upward

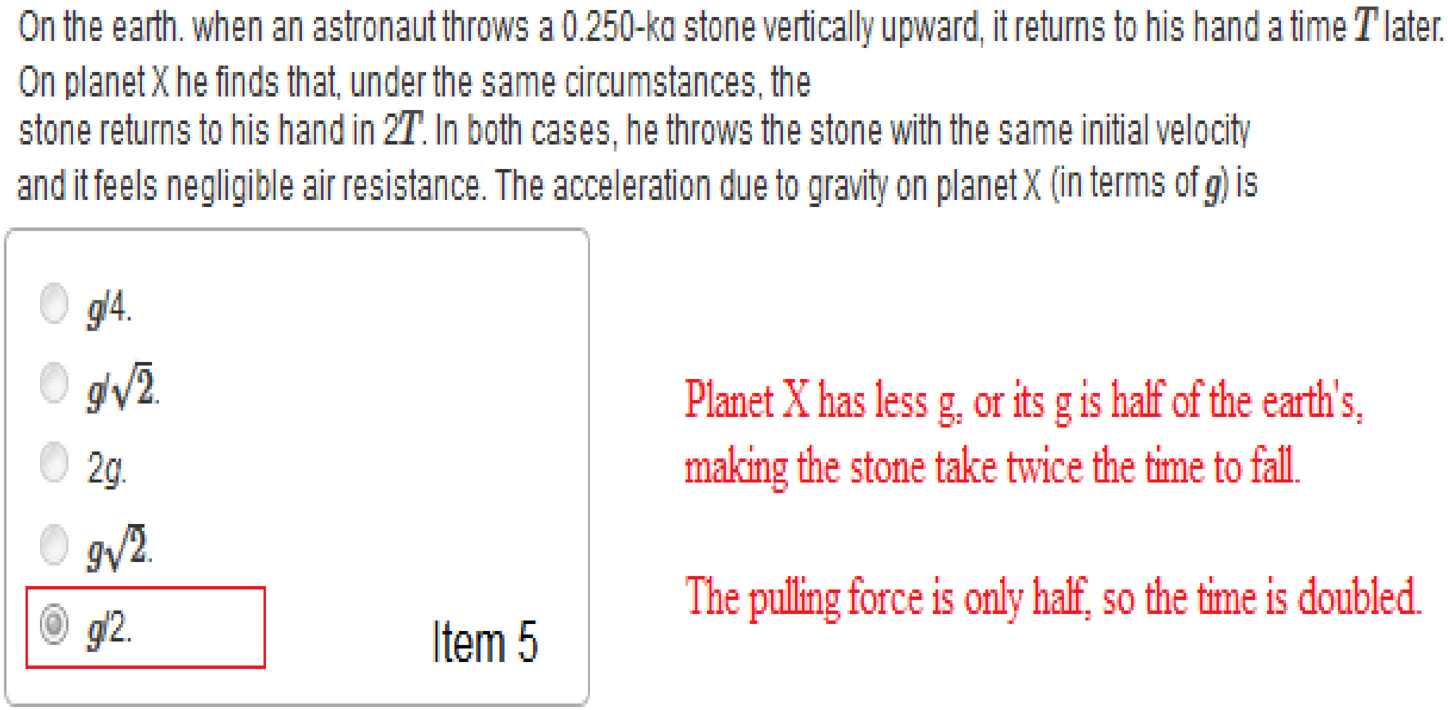
Item 4

Lets first find the distance between the cliff and the ground.

Y = ViT + 1/2AT^2 (The rock was dropped so Vi = 0)
Y = 1/2AT^2
Y = (1/2)(9.8)(3)^2
Y = 44.1 m

Now we can use that to help us find Vi with the second rock.

Y = ViT + 1/2AT^2
Vi = (Y - 1/2AT^2) / T
Vi = (44.1 - (1/2)(9.8)(2)^2) / 2
Vi = 12.25 m/s <--------Answer.



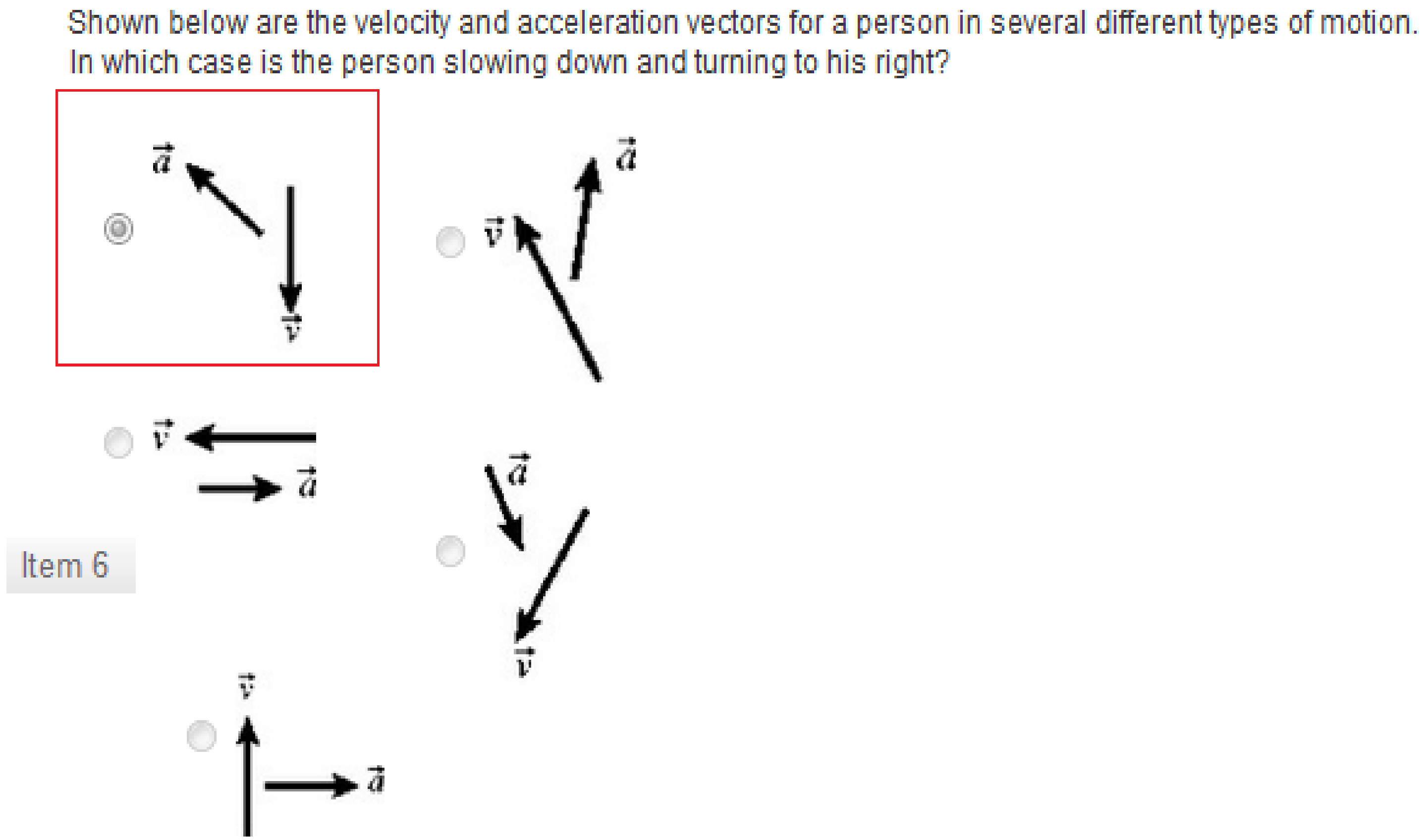
On the earth. when an astronaut throws a 0.250-kg stone vertically upward, it returns to his hand a time T later. On planet X he finds that, under the same circumstances, the stone returns to his hand in $2T$. In both cases, he throws the stone with the same initial velocity and it feels negligible air resistance. The acceleration due to gravity on planet X (in terms of g) is

- ○ $g/4$.
- ○ $g/\sqrt{2}$.
- ○ $2g$.
- ○ $g\sqrt{2}$.
- ● $g/2$.

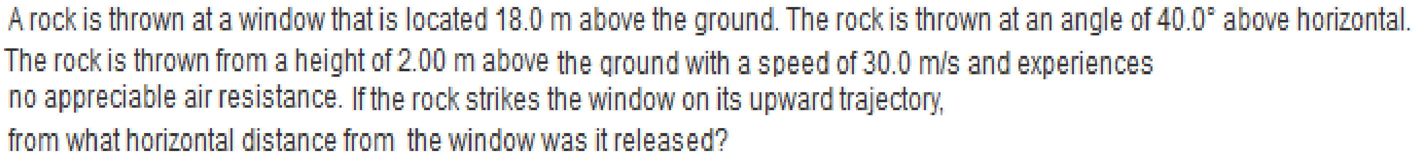
Item 5

Planet X has less g, or its g is half of the earth's, making the stone take twice the time to fall.

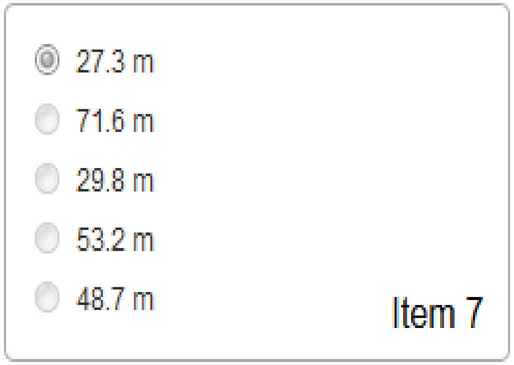
The pulling force is only half, so the time is doubled.



Shown below are the velocity and acceleration vectors for a person in several different types of motion. In which case is the person slowing down and turning to his right?

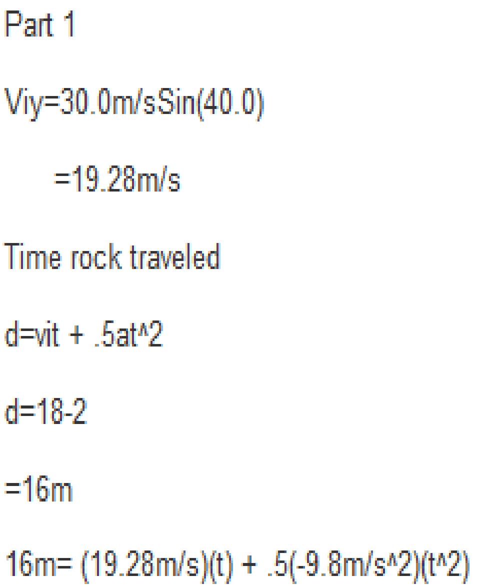


A rock is thrown at a window that is located 18.0 m above the ground. The rock is thrown at an angle of 40.0° above horizontal. The rock is thrown from a height of 2.00 m above the ground with a speed of 30.0 m/s and experiences no appreciable air resistance. If the rock strikes the window on its upward trajectory, from what horizontal distance from the window was it released?



- ● 27.3 m
- ○ 71.6 m
- ○ 29.8 m
- ○ 53.2 m
- ○ 48.7 m

Item 7



Part 1

Viy=30.0m/sSin(40.0)

=19.28m/s

Time rock traveled

d=vit + .5at^2

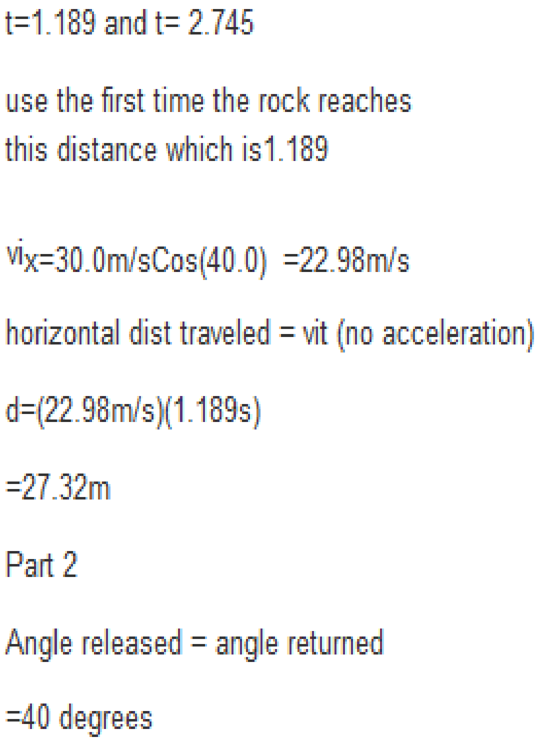
d=18-2

=16m

16m= (19.28m/s)(t) + .5(-9.8m/s^2)(t^2)

$((-1/2)(9.8)t^2-19.28t+16 = 0$

$t = 1.18943$ s



t=1.189 and t= 2.745

use the first time the rock reaches this distance which is1.189

vix=30.0m/sCos(40.0) =22.98m/s

horizontal dist traveled = vit (no acceleration)

d=(22.98m/s)(1.189s)

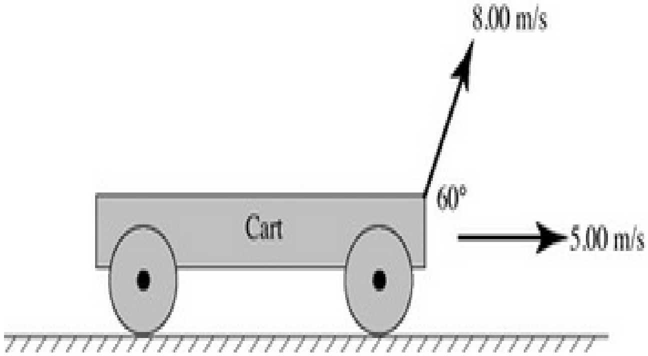
=27.32m

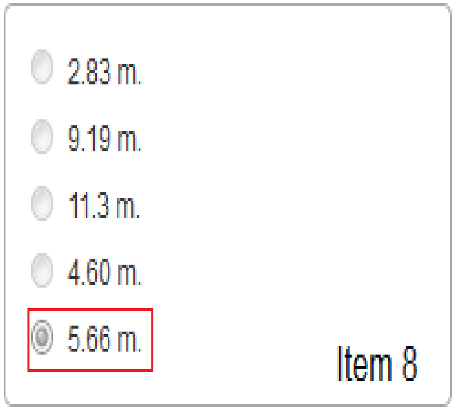
Part 2

Angle released = angle returned

=40 degrees

A cart is moving with a constant horizontal velocity of 5.00 m/s. A small pebble is launched from the front of the cart with a velocity of 8.00 m/s at 60.0° above the horizontal as measured relative to the cart (see figure) and experiences no significant air resistance. Just as the pebble returns to the level from which it was launched, its distance from the front of the cart is closest to





○ 2.83 m.

○ 9.19 m.

○ 11.3 m.

○ 4.60 m.

● 5.66 m.

Item 8

Classic projectile range problem. Work in reference frame of cart, so we don't ever need to worry about the fact that it is moving, or where it is when the pebble lands. To find the range solve for time:

$$t_{\frac{1}{2}} = \frac{v_{0y}}{g} \text{ (time for vertical velocity to go to zero is half way)}$$

$$\Delta x = v_{0x}t = v_{0x}\left(2t_{\frac{1}{2}}\right) = 2v_{0x}\frac{v_{0y}}{g} = \frac{2v_0^2\sin\theta\cos\theta}{g}$$

$$\Delta x = \frac{(2\cdot 8^2\cdot\sin(60°)\cdot\cos(60°))}{9.8} = 5.656\text{m}$$

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

○ 10.9 m

○ 25.5 m

○ 21.9 m

● 18.2 m

○ 14.6 m

Item 9

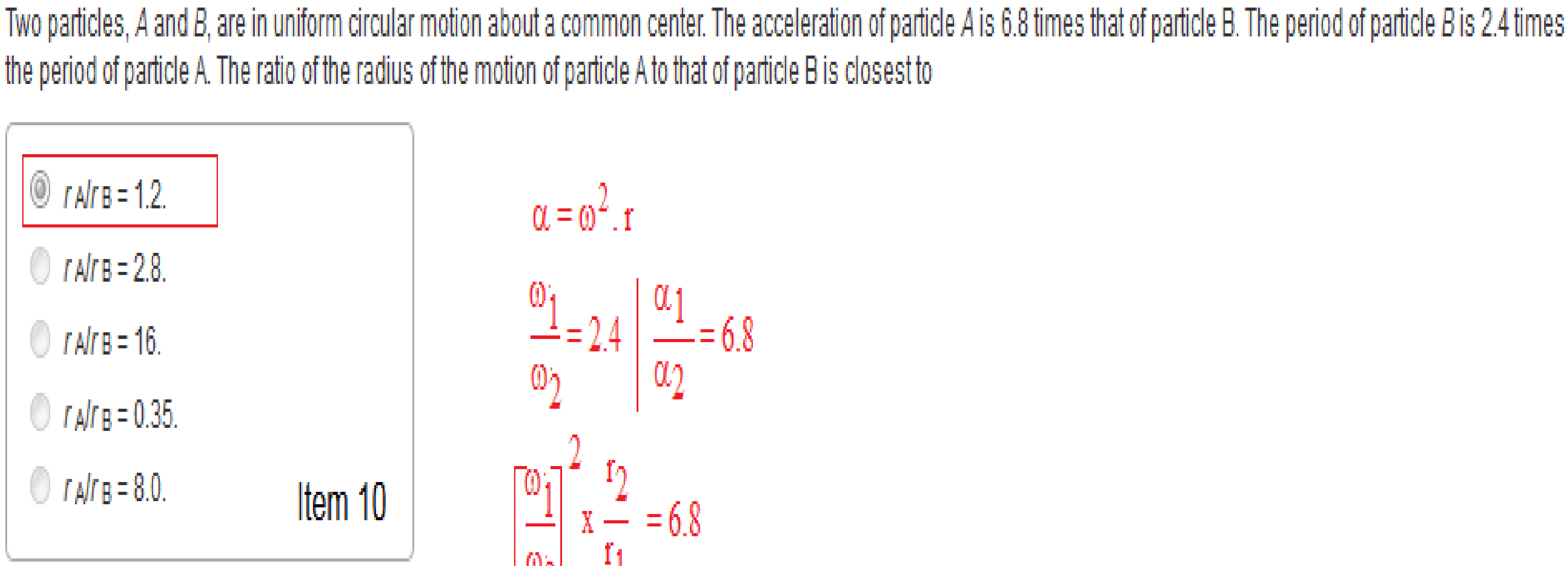
$$\vec{r}_{\mathrm{A}}(t) = (3.00\,\mathrm{m/s})t\,\hat{i} + (1.00\,\mathrm{m/s^2})t^2\,\hat{j}.$$

$$\vec{r}_{\mathrm{B}}(t) = (4.00\,\mathrm{m/s})t\,\hat{i} + (-1.00\,\mathrm{m/s^2})t^2\,\hat{j}.$$

$$\vec{r}_{\mathrm{A}}(3) = ((3\text{ m/s x }3\text{ s}) + (1\text{ m/s x }(3)^2\text{ s}) = 9i + 9j$$

$$\vec{r}_{\mathrm{B}}(3) = ((4\text{ m/s x }3\text{ s}) + (-1\text{ m/s x }(3)^2\text{ s}) = 12i - 9j$$

$$s(3) = \sqrt{((9 - 12)^2 + (9 - (-9))^2)} = 18.25\text{ m}$$



Two particles, *A* and *B*, are in uniform circular motion about a common center. The acceleration of particle *A* is 6.8 times that of particle B. The period of particle *B* is 2.4 times the period of particle A. The ratio of the radius of the motion of particle A to that of particle B is closest to

- ● $r_A/r_B = 1.2.$
- ○ $r_A/r_B = 2.8.$
- ○ $r_A/r_B = 16.$
- ○ $r_A/r_B = 0.35.$
- ○ $r_A/r_B = 8.0.$

Item 10

$$\alpha = \omega^2 . r$$

$$\frac{\omega_1}{\omega_2} = 2.4 \quad \Bigg| \quad \frac{\alpha_1}{\alpha_2} = 6.8$$

$$\left[\frac{\omega_1}{\omega_2}\right]^2 x \frac{r_2}{r_1} = 6.8$$

$$\frac{r_2}{r_1} = \frac{6.8}{2.4^2} = 1.18 \text{ or } 1.2$$