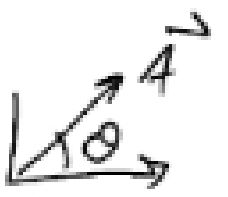
PHYS 1111, Section 3, Fall 2014
Test no. 1, version 1
September 11, 2014
11:00am – 12:15pm

KEY

NOTE: This test consists of 20 multiple choice problems. 18 of the problems are required, while the extra 2 are for bonus points. Fill in your name, Student ID, Version number, and answers on the scantron sheet. You may keep the problem sheet when you are finished. An equation sheet appears on the last page.

TRUE/FALSE. Choose 'True' if the statement is true and 'False' if the statement is false.

1) A component of a vector can be greater than the vector's magnitude.
A) True (B) False
$|A_x| = |A\cos\theta| \le A$
$|A_y| = |A\sin\theta| \le A$



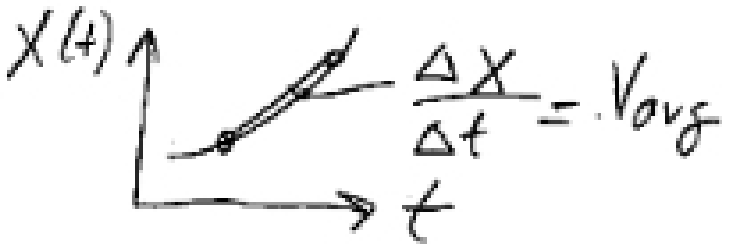
1) B

2) If $\vec{A} - \vec{B} = 0$, then the vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes and are directed in the same direction.
(A) True B) False

2) A

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

3) The slope of a line connecting two points on a position versus time graph gives
A) instantaneous acceleration.
B) instantaneous velocity.
(C) average velocity.
D) displacement.
E) average acceleration.



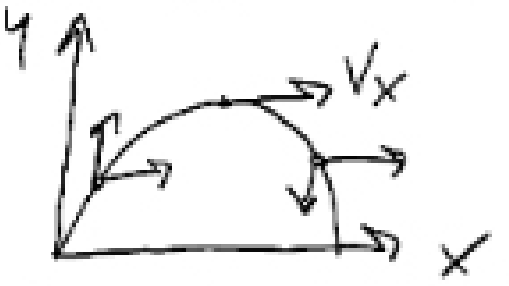
3) C

4) A vector is located in the x–y plane. The x– and y–components of this vector are 4.00 m and 3.00 m, respectively. Find the angle that this vector makes with the positive x–axis.
A) 22.4° B) 48.6° C) 126.9° D) 53.1° (E) 36.9°

$\theta = \tan^{-1}\left(\frac{A_y}{A_x}\right) = \tan^{-1}\left(\frac{3}{4}\right) = 36.9^\circ$

4) E

5) For general projectile motion, the horizontal component of a projectile's velocity
A) is zero.
B) continuously decreases.
(C) remains a non–zero constant.
D) continuously increases.
E) any of the above, depending on position.



5) C

6) In solving a physics problem you end up with m in the numerator and m/s in the denominator. The units for your answer are
$\frac{m}{m/s} =$ (A) s. B) m^2/s. C) 1/s. D) m^2. E) m.

6) A

7) A car is moving with a speed of 32.0 m/s. The driver sees an accident ahead and slams on the brakes, giving the car a deceleration of 3.50 m/s^2. How far does the car travel after the driver put on the brakes before it comes to a stop?
A) 112 m B) 4.57 m C) 292 m D) 9.14 m (E) 146 m

v_{xi}, a_x

$t_i = 0$, $x_i = 0$, $v_f = 0$, $x_f = ?$

$v_f^2 = v_{xi}^2 + 2a_x(x_f - x_i)$

$0 = v_{xi}^2 + 2a_x x_f$

$x_f = -\frac{v_{xi}^2}{2a_x} = -\frac{(32)^2}{2(-3.50)} = 146\ m$

7) E

$V_{yf}^2 = V_{yi}^2 - 2g(y_f - y_i)$

$= 13^2 - 2(9.81)(4)$

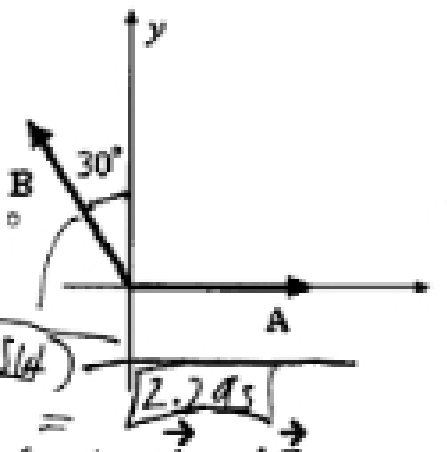
$= 90.52 \text{ m/s}^2$

$V_{yf} = -9.514 \text{ m/s}$

$V_{yf} = V_{yi} - g t_f$

$t_f = \frac{V_{yi} - V_{yf}}{g} = \frac{13 - (-9.514)}{9.81} = 2.295$

FIGURE 1



$A_x = A\cos 0° = A$

$A_y = A\sin 0° = 0 = A\cos 90°$

$B_x = -B\cos 60°$

$B_y = B\sin 60°$

8) Refer to Figure 1. The components of vectors $\vec{A}$ and $\vec{B}$ are 8) E

A) $A_x = A\cos 90°$	$B_x = B\sin 60°$	$A_y = A\sin 90°$	$B_y = B\cos 60°$.
B) $A_x = 0$	$B_x = B\sin 30°$	$A_y = 0$	$B_y = B\cos 30°$.
C) $A_x = A\cos 90°$	$B_x = 0$	$A_y = A\sin 90°$	$B_y = 0$
D) $A_x = A\sin 90°$	$B_x = B\cos 60°$	$A_y = A\cos 90°$	$B_y = B\sin 60°$.
E) $A_x = A\cos 0°$	$B_x = -B\cos 60°$	$A_y = A\cos 90°$	$B_y = B\cos 30°$.

9) An object is thrown upwards with a speed of 13 m/s. How long does it take to reach a height of 4.0 m above the projection point while descending? 9) A

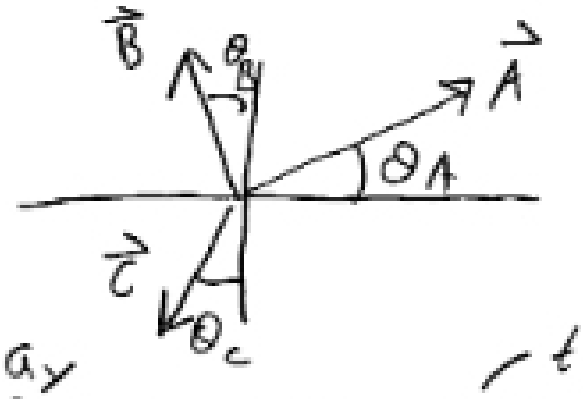
A) 2.3 s B) 4.2 s C) 1.2 s D) 0.42 s E) 3.1 s

$V_{yi} = 13 \text{ m/s}$, $a_y = -g$, $t_i = 0$, $y_i = 0$, $y_f = 4.0 \text{ m}$, $V_{yf} < 0$

10) Vector $\vec{A}$ = 8.0 m and points 30° north of east, Vector $\vec{B}$ = 6.0 m and points 30° west of north, and vector $\vec{C}$ = 5.0 m and points 30° west of south. The resultant vector $\vec{A} + \vec{B} + \vec{C}$ is given by 10) B

A) 5.9 m at an angle 74° north of east.
B) 5.1 m at an angle 74° north of east.
C) 2.1 m at an angle 66° east of north.
D) 2.7 m at an angle 74° north of east.
E) 4.8 m at an angle 74° east of north.

(See last page)



$A_x = A\cos\theta_A = 8\cos 30°$

$B_x = -B\sin\theta_B = -6\sin 30°$

$C_x = -C\sin\theta_C = -5\sin 30°$

V_{xi} a_y t_f

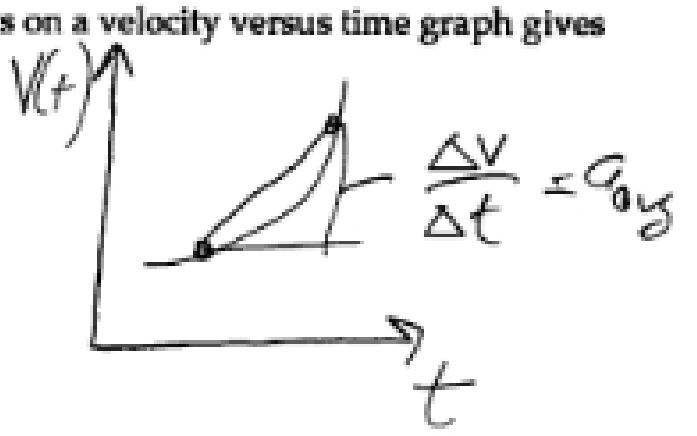
11) A car starts from rest and accelerates at 6.00 m/s^2. How far does it travel in 3.00 s? 11) E

A) 9.00 m B) 18.0 m C) 36.0 m D) 54.0 m E) 27.0 m

$x_f = x_i + V_{xi} t_f + \frac{1}{2} a_x t_f^2 = 0 + (0)(3) + \frac{1}{2}(6)(3^2) = 27.0 \text{ m}$

12) The slope of a line connecting two points on a velocity versus time graph gives 12) B

A) average velocity.
B) average acceleration.
C) instantaneous velocity.
D) instantaneous acceleration.
E) displacement.



$\frac{\Delta V}{\Delta t} = a_y$

$1\ m^2 \times \frac{(100\ cm)^2}{(1\ m)^2} = 10^4\ cm^2$

13) How many cm^2 equal a m^2? 13) D

A) 10^{-2} B) 10^{-4} C) 10^2 D) 10^4 E) 10^6

14) A bullet is fired with a certain velocity at an angle θ above the horizontal at a location where g = 10.0 m/s^2. The initial x- and y-components of its velocity are 86.6 m/s and 50.0 m/s respectively. How long does it take before the bullet hits the ground? 14) A

A) 10.0 seconds
B) 5.0 seconds
C) 20.0 seconds
D) 15.0 seconds
E) None of the other choices is correct.

$y_i = 0,\ y_f = 0$

$v_i = 0,\ v_{yi} = 50\ m/s$

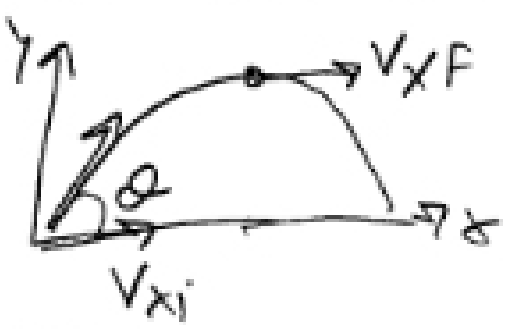
$y_f = y_i + v_{yi} t_f - \frac{1}{2} g t_f^2$

$0 = 0 + v_{yi} t_f - \frac{1}{2} g t_f^2$

$t_f = \frac{2 v_{yi}}{g} = \frac{2(50)}{10} = 10.0\ s$

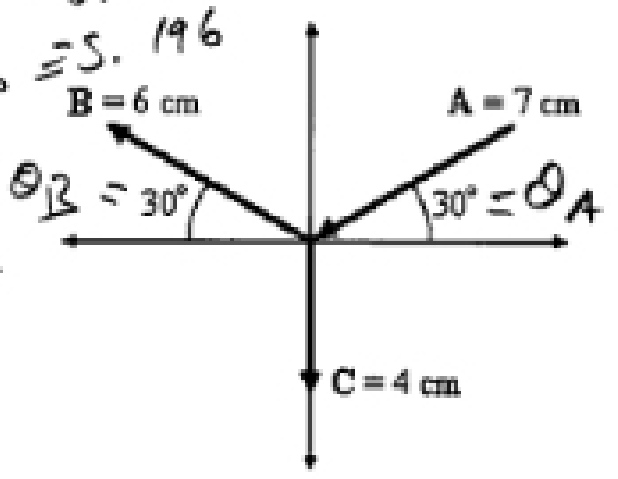
15) A rock is thrown at some angle above the horizontal with a certain velocity. It reaches its highest point and starts falling down. What is the velocity of the rock at the highest point of its trajectory? 15) B

A) 0
B) It is equal to its initial horizontal velocity.
C) 9.8 m/s
D) It is equal to its initial velocity.
E) It is equal to its initial vertical velocity.



$V_{xf} = V_{xi}$

FIGURE 2



$A_x = A\cos\theta_A = -7\cos 30° = -6.062$

$B_x = -B\cos\theta_B = -6\cos 30° = 5.196$

$C_x = 0$

$R_x = -11.258$ cm

$A_y = A\sin\theta_A = -7\sin 30° = -3.5$

$B_y = B\sin\theta_B = 6\sin 30° = 3$

$C_y = -C\sin 90° = -4$

$R_y = -4.5$ cm

16) Refer to **Figure 2**. The magnitudes of the vectors shown in the figure are $\vec{A}$ = 7.0 cm, $\vec{B}$ = 6.0 cm, and $\vec{C}$ = 4.0 cm. The components of the resultant vector are given by 16) B

Choice	x-component	y-component
	cm	cm
1	-8.7	-4.5
2	-11.3	-4.5
3	0	2.4
4	-4.5	-11.3
5	2.4	-8.7

A) Choice 1 B) Choice 2 C) Choice 3 D) Choice 4 E) Choice 5