

EXAM 1

Name: _____

Student ID #: _____

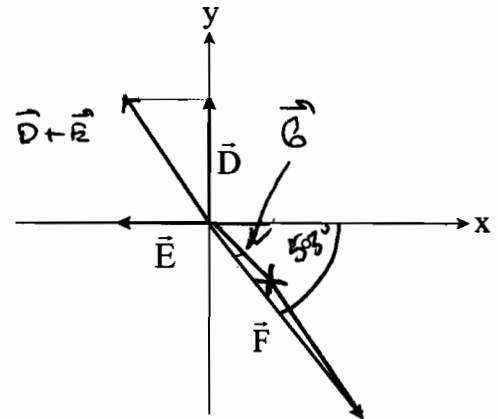
TA (circle one): Golda Kamdem Matthew Michael Paul

A. [8 pts.] Three vectors, \vec{D} , \vec{E} and \vec{F} , are shown in the drawing.

$\vec{D} = 5.00 \text{ m}$; $\vec{E} = 3.00 \text{ m}$; $\vec{F} = 10.00 \text{ m}$
 $\vec{F}_x = 6.00$
 $\vec{F}_y = -8.00$

- On the drawing, show the vector sum $\vec{D} + \vec{E}$.
- On the drawing, show the vector sum $\vec{D} + \vec{E} + \vec{F}$.
- Express the sum vector $\vec{G} = \vec{D} + \vec{E} + \vec{F}$ in unit vector notation.

$\vec{G} = (3.00 \text{ m})\hat{i} + (-3.00 \text{ m})\hat{j}$

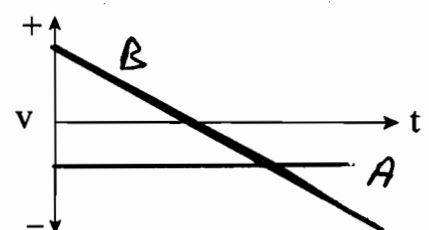
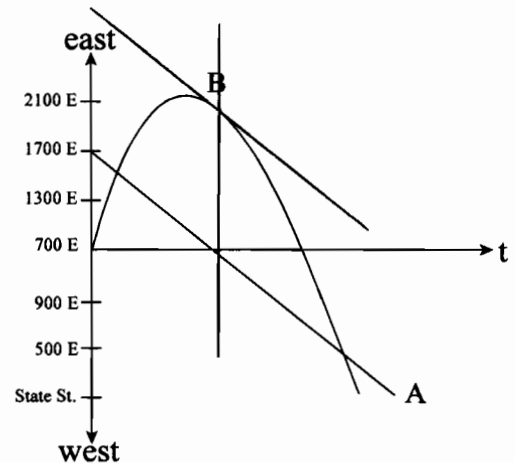


B. [16 pts.] Vector \vec{A} has a magnitude of 20.0 units and points due west. \vec{B} is a vector that has a magnitude of 10.0 units. In each parentheses circle the best answer.

- If \vec{B} points due west, the vector $\vec{A} + \vec{B}$ has a magnitude that is (greater than, less than, equal to) 20.0 units and points (north, south, east, west).
- If \vec{B} points due west, the vector $\vec{B} - \vec{A}$ has a magnitude that is (greater than, less than, equal to) 20.0 units and points (north, south, east, west).
- If \vec{B} points due east, the vector $\vec{B} - \vec{A}$ has a magnitude that is (greater than, less than, equal to) 20.0 units and points due (north, south, east, west).
- If \vec{B} points due south, the vectors $\vec{A} - \vec{B}$ has a magnitude that is (greater than, less than, equal to) 20.0 units and points (south of west, west of north, north of east, east of south).

C. [14 pts.] Two vehicles are traveling east-west along 3300 South as shown on the position vs. time plot. On this plot 700 East is the origin and east is the positive direction. In the blanks below, enter A, B, both, or neither that best answers the questions.

- NEITHER Which car is traveling in an easterly direction during its entire motion?
- A Which car is traveling in a westerly direction during its entire motion?
- B Which car momentarily stops and reverses direction?
- B Which car has the greater speed at the instant they pass one another?
- B At the instant the two cars have the same velocity, which car is farther east?
- Draw a vertical line on the graph passing through both plots that marks the instant the two cars have the same velocity.
- On the empty plot, v vs. t, draw the v vs. t graph for both cars.



Name: _____

Student ID #: _____

TA (circle one): Golda Kamdem Matthew Michael Paul

A police car is traveling at a velocity of 20.0 m/s due south on I-15 when a roadster zooms by at a constant velocity of 45.0 m/s. After the roadster passes the police car it takes the policeman 2.00 s to check the speed of the roadster on his radar gun and hit the accelerator. The police car then takes off after the roadster at a constant 5.00 m/s² acceleration.

A. [16 pts.] Setting $t_0 = 0$ at the instant the police car starts accelerating and x_0 (police car) = 0, how long does it take the police car to catch the roadster?

POLICE CAR
 $x_{op} = 0$
 $x = ?$
 $v_{op} = 20.0 \text{ m/s}$
 $v_p = ?$
 $a_p = 5.00 \text{ m/s}^2$
 $t = ?$

ROADSTER
 $x_{or} = 50.0 \text{ m}$
 $x_R = ?$
 $v_{or} = 45 \text{ m/s}$
 $v_R = 45 \text{ m/s}$
 $a_R = 0$

$$x_{or} = (45 \text{ m/s} - 20 \text{ m/s})(2.00 \text{ s}) = 50.0 \text{ m}$$

$$x_R = x_{or} + v_{or}t + \frac{1}{2}a_R t^2 = 50 \text{ m} + (45 \text{ m/s})t$$

$$x_p = x_{op} + v_{op}t + \frac{1}{2}a_p t^2 = (20 \text{ m/s})t + (2.5 \text{ m/s}^2)t^2$$

SET $x_p = x_R$

$$50 \text{ m} + (45 \text{ m/s})t = (20 \text{ m/s})t + (2.5 \text{ m/s}^2)t^2$$

$$(2.5 \text{ m/s}^2)t^2 - (25 \text{ m/s})t - 50 \text{ m} = 0$$

$$t = \frac{25 \pm \sqrt{(25)^2 + 500}}{5} = \frac{25 \pm 33.5}{5}$$

$t = 11.75, -1.81 \text{ s}$

SELECT
 $t = 11.75$

B. [8 pts.] How far did the police car travel from the moment the policeman hit the accelerator to the instant the police car caught the roadster?

DISTANCE POLICE CAR TRAVELLED IS x_p

$$x_p = (20 \text{ m/s})t + (2.5 \text{ m/s}^2)t^2$$

$$= (20 \text{ m/s})(11.75) + (2.5 \text{ m/s}^2)(11.75)^2$$

$x_p = 576 \text{ m}$

C. [8 pts.] At the instant the police car caught the roadster, what was the velocity of each vehicle?

$v_R = 45.0 \text{ m/s}$

$v_p = v_{op} + a_p t = (20 \text{ m/s}) + (5.00 \text{ m/s}^2)(11.75)$

$v_p = 78.5 \text{ m/s}$

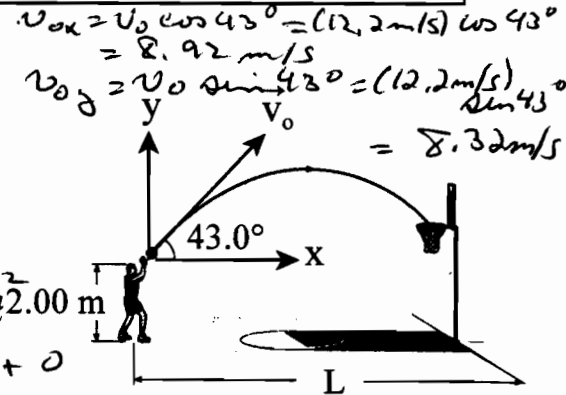
WOW!

Name: _____

Student ID #: _____

TA (circle one): Golda Kamdem Matthew Michael Paul

A basketball player standing on the floor is 14.0 m (L) from the basket as shown in the figure. The player shoots the basketball with an initial speed of $v_0 = 12.2$ m/s at an angle of $\theta = 43.0^\circ$ above the horizontal. The shot is a "swish" through the basket.



A. [10 pts.] How long does it take for the ball to go from the hands of the player until it reaches the basket?

<u>X DATA</u>	<u>Y-DATA</u>	
$x_0 = 0$	$y_0 = 2.00 \text{ m}$	$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$
$x = 14.0 \text{ m}$	$y = ?$	$x = 0 + (8.92 \text{ m/s})t + 0$
$v_{0x} = 8.92 \text{ m/s}$	$v_{0y} = 8.32 \text{ m/s}$	$= 14.0 \text{ m}$
$v_x = 8.92 \text{ m/s}$	$v_y = ?$	$t = \frac{14.0 \text{ m}}{8.92 \text{ m/s}}$
$a_x = 0$	$a_y = -9.8 \text{ m/s}^2$	
$t = ?$		

$t = 1.57 \text{ s}$

B. [10 pts.] What is the highest point above the floor the basketball reaches?

HIGHEST POINT IS $2.00 \text{ m} + y_{\text{TOP}}$
 USE $v_y^2 = v_{0y}^2 + 2a_y(y_{\text{TOP}} - y_0)$
 $y_{\text{TOP}} = \frac{-v_{0y}}{2a_y} = \frac{-(8.32 \text{ m/s})}{(2)(-9.8 \text{ m/s}^2)} = 3.53 \text{ m}$

HIGHEST PT. IS
 $3.53 \text{ m} + 2.00 \text{ m} = 5.53 \text{ m}$

C. [10 pts.] How fast is the ball traveling when it reaches to the basket?

HOW FAST = $v = \sqrt{v_x^2 + v_y^2}$
 $v_x = v_{0x} = 8.92 \text{ m/s}$
 $v_y = v_{0y} + a_y t = 8.32 \text{ m/s} + (-9.8 \text{ m/s}^2)(1.57 \text{ s})$
 $v_y = -7.07 \text{ m/s}$
 $v = \sqrt{(8.92 \text{ m/s})^2 + (-7.07 \text{ m/s})^2} = 11.4 \text{ m/s}$