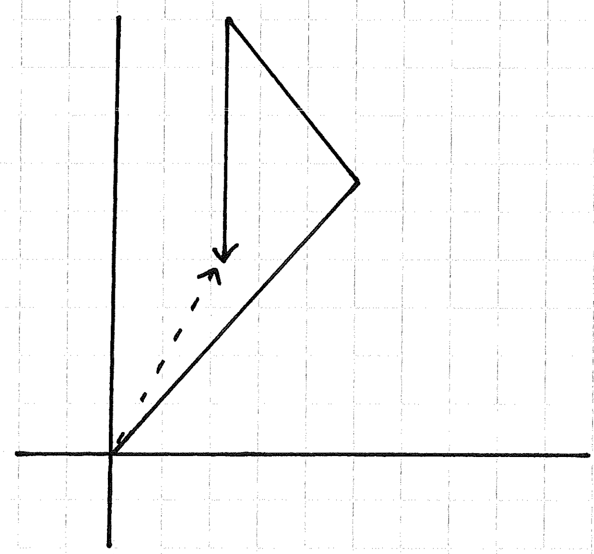
EXAM 2 FREE RESPONSE PRACTICE

1a.



b. $D_1 = \langle 50.9, 56.5 \rangle$ mi

c. $D_2 = \langle -28.0, 41.5 \rangle$ mi

d. $D_3 = \langle 0, -47 \rangle$ mi

e. $D_1 + D_2 + D_3 = \langle 22.9, 51 \rangle$

$= 55.9$ mi

f.

$$\theta = \tan^{-1}\left[\frac{51}{22.9}\right] = 65.8^\circ$$

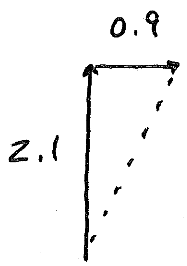
g. $76 + 50 + 47 = 173$ mi

2a.

X	Y
$\Delta s = 36.4$	$\Delta s = 85$
$v = 0.9$	$v = 2.1$
$\Delta t = 40.5$	$\Delta t = 40.5$

$$\Delta S_x = 36.4\,m$$

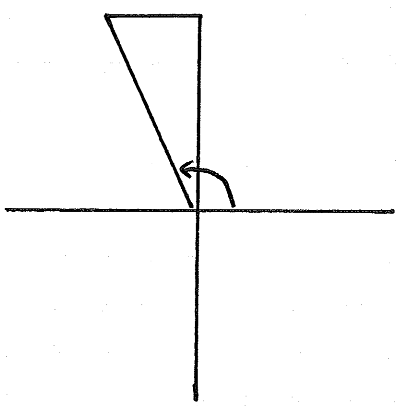
b.



$$\text{SPEED} = \sqrt{0.9^2 + 2.1^2} = 2.285\ m/s$$

c. $$\theta = \tan^{-1}\left[\frac{2.1}{0.9}\right] = 66.8^\circ$$

d.



$$\theta = \tan^{-1}\left[\frac{2.1}{-0.9}\right] = 113.2^\circ$$

$-0.9\ m/s$ IS CHOSEN IN THE X-DIMENSION TO COUNTERACT THE CURRENT

e.

AT THE SAME Y-VELOCITY, IT WILL TAKE MORE TIME TO TRAVEL A GREATER Y-DISPLACEMENT.

IN THIS GREATER TIME, THE BOAT WILL DRIFT EAST FURTHER FOR A GIVEN OCEAN CURRENT VELOCITY.

3 a. $\bar{a} = \dfrac{\Delta v}{\Delta t} = \dfrac{20 \text{ m/s}}{0.05 \text{ s}} = 400 \text{ m/s}^2$

$\bar{F} = m \cdot \bar{a} = (0.5)(400) = 200 \text{ N}$

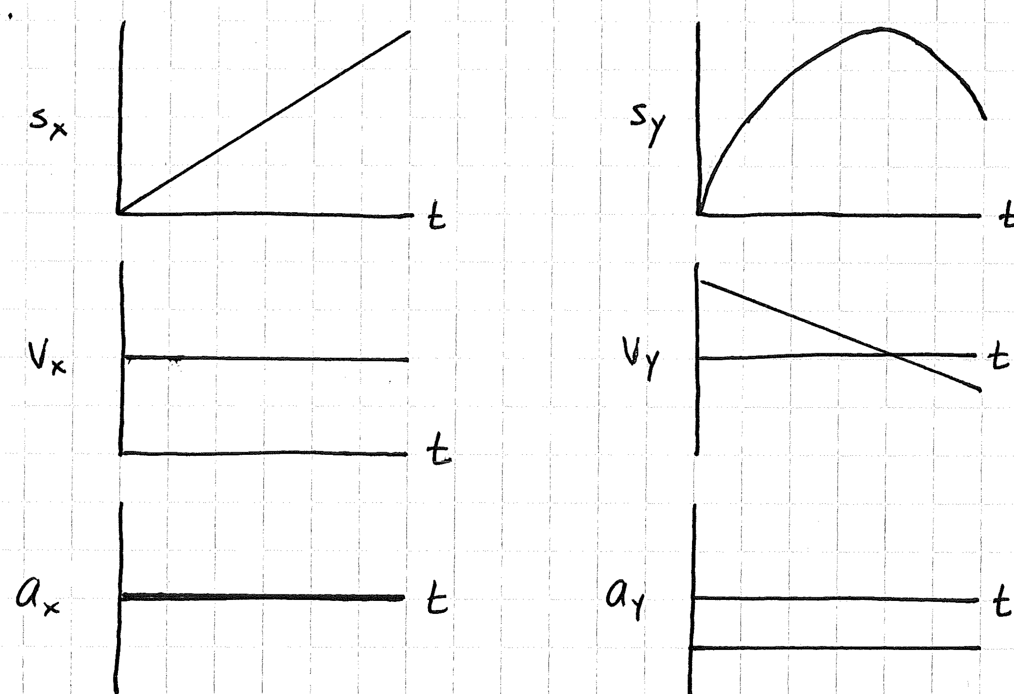
b.

X	Y	
$\Delta s = 32$	$\Delta s = 4$	$\bar{v} = 2$
$v = 16$	$v_i = 12$	$a = -10$
$\Delta t = 2$	$v_f = -8$	$\Delta t = 2$

$\Delta t = 2$ SECONDS

c. IF $\Delta s_y = 4\text{m}$, THE BALL WILL CLEAR THE FENCE BY 1.5m.

d.



e. THE v_x AND a_x GRAPHS WOULD BE THE SAME.

THE a_y GRAPH WOULD HAVE A LESS NEGATIVE, CONSTANT VALUE.

THE v_y GRAPH WOULD HAVE A SHALLOWER NEGATIVE SLOPE.

4a.

x	y
$\Delta s = 906.3$	$\Delta s = 0 \quad \bar{v} = 0$
$v = 90.63$	$v_i = 42.26 \quad a = -8.452$
$\Delta t = 10$	$v_f = -42.26 \quad \Delta t = 10$

$g = 8.452 \ m/s^2$

b.

x	y
$\Delta s = 453.15$	$\Delta s = 105.65 \quad \bar{v} = 21.13$
$v = 90.63$	$v_i = 42.26 \quad a = -8.452$
$\Delta t = 5$	$v_f = 0 \quad \Delta t = 5$

$h_{MAX} = 105.65 m$

c. No, $906.3m < 1600m$

d.

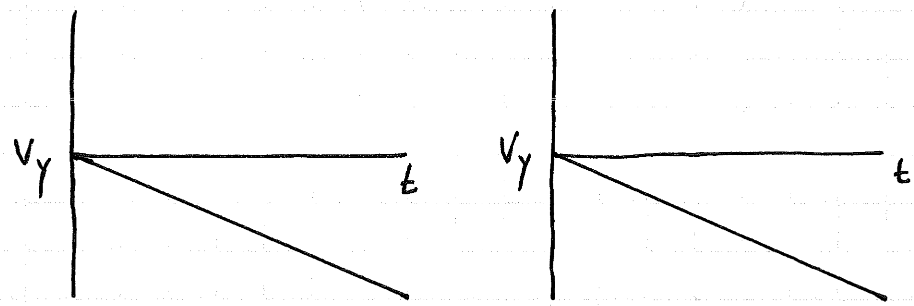
x	y
$\Delta s = 591.5m$	$\Delta s = 0 \quad \bar{v} = 0$
$v = 25.88$	$v_i = 96.59 \quad a = -8.452$
$\Delta t = 22.857$	$v_f = -96.59 \quad \Delta t = 22.857$

$591.5m < 906.3m$

ALSO $\Delta S_x = \dfrac{v_i^2 \sin 2\theta}{g}$ AND $\sin 50° > \sin 150°$

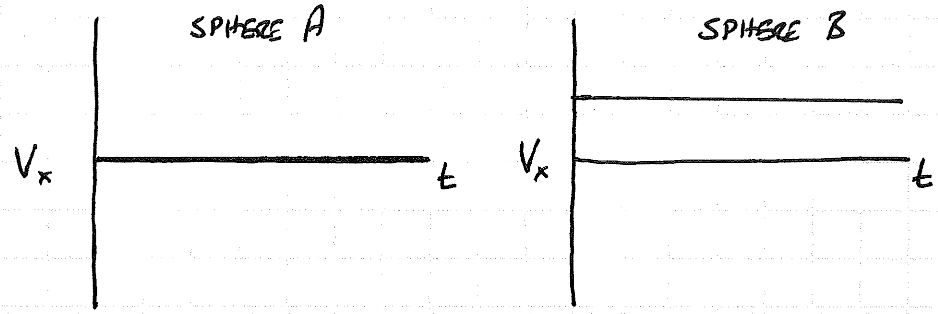
5a.

SPHERE A SPHERE B



b.

SPHERE A SPHERE B



c. INDEPENDENT OF THE DIFFERENT HORIZONTAL VELOCITIES SHOWN IN (b), THE VERTICAL VELOCITIES SHOWN IN (a) ARE IDENTICAL FUNCTIONS OF TIME.

BECAUSE THE AREAS ARE ALSO SIMILAR FUNCTIONS OF TIME, THE TWO SPHERES WILL HAVE THE SAME DISPLACEMENTS AT ANY TIME AND SO LAND TOGETHER.

6 a. BEFORE A PIN IS STRUCK, IT HAS A VELOCITY OF ZERO. IT WILL NATURALLY MAINTAIN THAT STATE OF REST (ZERO VELOCITY).

b. WHEN THE BALL STRIKES THE HEAD PIN, IT APPLIES A FORCE TO THAT PIN. IF THIS IS THE ONLY HORIZONTAL FORCE ON THE PIN, THEN:

$$\Sigma F_x = m \cdot a$$

$$F_{BB\ ON\ PIN} = m_{PIN} \cdot a_{PIN}$$

c. WHEN THE BALL APPLIES A FORCE FORWARD ON THE HEAD PIN, THE HEAD PIN APPLIES AN EQUIVALENT FORCE BACKWARD ON THE BALL.