■ KEY ■

First Name: _____   Last Name: _____

L11 – Adding Vectors in 2-Dimensions – Formative Quiz

Use the following information to answer Q1-Q3:

A bank robber sprints 50m [40° N of E] through a park, then turns and runs 200m [E] down an alley before being tackled by Batman.
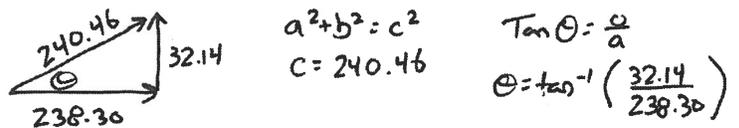
Q1: When running down the alley, which best describes the x- and y-component of the robber's displacement?

	x-component	y-component
A.	+0	+200
B.	+200	+0
C.	+32.14	+38.30
(D.)	+38.30	+32.14

	x-comp	y-comp
	$\cos\theta = \frac{a}{h}$	$\sin\theta = \frac{o}{h}$
	$\cos 40 = \frac{d_{1x}}{50}$	$\sin\theta = \frac{d_{1y}}{50}$
	$d_{1x} = +38.30$	$d_{1y} = +32.14$
	$d_{2x} = +200$	$d_{2y} = +0$
$\vec{d}_{TOT}$	$d_{TOTx} = +238.30$	$d_{TOTy} = +32.14$

Q2: The total distance the robber ran is

Not displacement

$d_{TOT} = d_1 + d_2$
$= 50 + 200$
$= 250\,m$

a. 240.5 m
(b) 250.0 m
c. 260.8 m
d. 270.4 m

$a^2 + b^2 = c^2$
$c = 240.46$

$\tan\theta = \frac{o}{a}$
$\theta = \tan^{-1}\left(\frac{32.14}{238.30}\right)$

240.46   32.14
238.30

$\vec{d}_{TOT} = 240.46\,m\ [7.68\ N\ of\ E]$

Q3: If Batman had glided from the robber's initial position directly to the robber's final position, then Batman would have to glide at an angle of ____ degrees *North of East.*
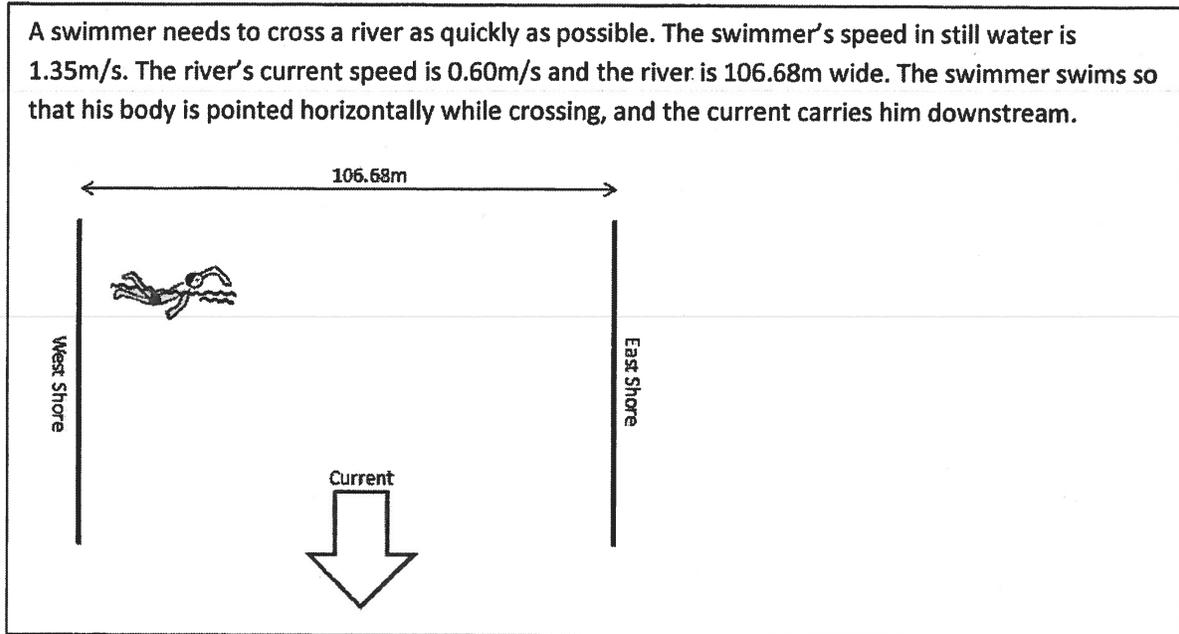
*(Record your **three-digit** answer in the Numerical Response boxes below)*

7	.	6	8

*Use the following information to answer Q4:*

A swimmer needs to cross a river as quickly as possible. The swimmer's speed in still water is 1.35m/s. The river's current speed is 0.60m/s and the river is 106.68m wide. The swimmer swims so that his body is pointed horizontally while crossing, and the current carries him downstream.

106.68m

West Shore

East Shore

Current

Q4: The swimmer's net velocity, relative to the shore, is *a.b* m/s [*ef*° S of E], where *a, b, e,* and *f* are ___, ___, ___, and ___.

(Record your four-digit answer in the Numerical Response boxes below)

| 1 | 5 | 2 | 4 |

$\vec{v}_1 = 1.35 m/s$

$\vec{v}_2 = 0.60 m/s$
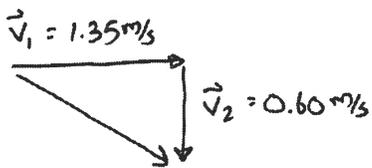
$a^2 + b^2 = c^2$
$c = 1.477 m/s$

$Tan\ \Theta = \frac{o}{a}$
$\Theta = tan^{-1}\left(\frac{0.6}{1.35}\right)$
$\Theta = 23.96°$

$\vec{v}_{TOT} = 1.477 m/s\ [23.96°\ S\ of\ E]$

$\vec{v}_{TOT} \approx 1.5\ m/s\ [24°\ S\ of\ E]$
$\quad\quad\quad a.b \quad\quad cd°$

Q5: John jogs at 2.6 m/s [30^0 N of E] for 100 seconds, then turns and runs at 5.4 m/s [80^0 N of E] for 60 seconds. What is John's total displacement? *(2 marks)*

$2.6 \, m/s \times 100s = 260m$

$5.4 \, m/s \times 60s = 324m$
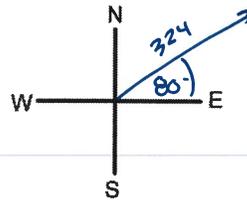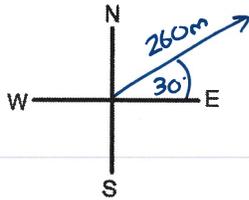
Vector	x-Component	y-Component	OPTIONAL Unit Vectors
260 [30°]	$\cos\Theta = \frac{a}{h}$ $\cos 30 = \frac{dx}{260}$ $dx = +225.17$	$\sin\Theta = \frac{o}{h}$ $\sin 30 = \frac{dy}{260}$ $dy = +130.00$	$\Delta\vec{d_1} = 225.17\,\hat{i} + 130.00\,\hat{j}$
324 [80°]	$\cos\Theta = \frac{a}{h}$ $\cos 80 = \frac{dx}{324}$ $dx = +56.26$	$\sin\Theta = \frac{o}{h}$ $\sin 80 = \frac{dy}{324}$ $dy = +319.08$	$\Delta\vec{d_2} = 56.26\,\hat{i} + 319.08\,\hat{j}$
Resultant	$d_{TOT_x} = 281.43$	$d_{TOT_y} = 449.08$	$\Delta d_{TOT} = 281.43\,\hat{i} + 449.08\,\hat{j}$
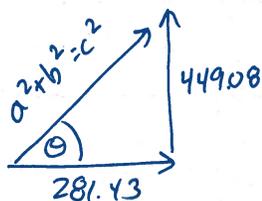
$a^2 + b^2 = c^2$

449.08

281.43

Mag

$a^2 + b^2 = c^2$

$c = 529.98$

Angle

$\tan\Theta = \frac{o}{a}$

$\Theta = \tan^{-1}\left(\frac{449.08}{281.43}\right)$

$\Theta = 57.93°$ N of E

$\Delta\vec{d} = 529.98m \; [57.93° \, N \, of \, E]$

MARKING

Beginning	0.0 – 3.0
Progressing	3.5 – 4.5
Competent	5.0 – 6.5
Exemplary	7.0