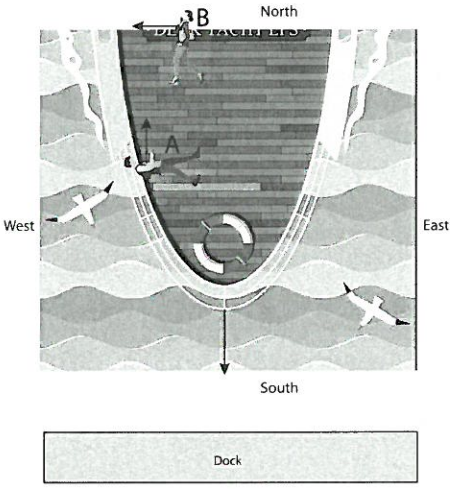
	Total	K+E	I+O
Student	31	15	16
Average	28.9/50	29.8/50	28.0/50
Best	44.5/50	44.5/50	43.0/50

11th Physics (2019 – 20)

(1stQ, #2 Mini Test)

Class	No.	Name Solutions



In calculation problems, describe equations clearly and systematically enough to show how to solve the problems. <u>If not enough, you won't get any points.</u>

Gravitational acceleration rate	$g = 9.80\ m/s^2$
The density of pure water	ρ (water) $= 1000\ kg/m^3$
The density of steel	ρ (steel) $= 8050\ kg/m^3$

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5 pt/question x 10 questions = 50 pt Max 50 pt

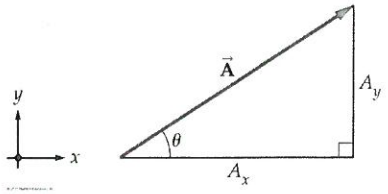
/[Total 50 pt]

10/10/2019 *By Tohei Moritani*

Keio Academy of New York

(1-a) Find A_x and A_y for the vector $\vec{A}$ with magnitude and direction given by A = 3.52 cm and $\theta = 46.0^\circ$, respectively.

(Equations)



$$A_x = A\cos\theta = 3.52\cos 46.0^\circ = 2.4452 \longrightarrow 2.45 \text{ (cm)}$$

$$A_y = A\sin\theta = 3.52\sin 46.0^\circ = 2.532 \longrightarrow 2.53 \text{ (cm)}$$

(1-b) Find B and θ for the vector $\vec{B}$ with components B_x = 75.5 cm and B_y = 6.20 cm.

(Equations)

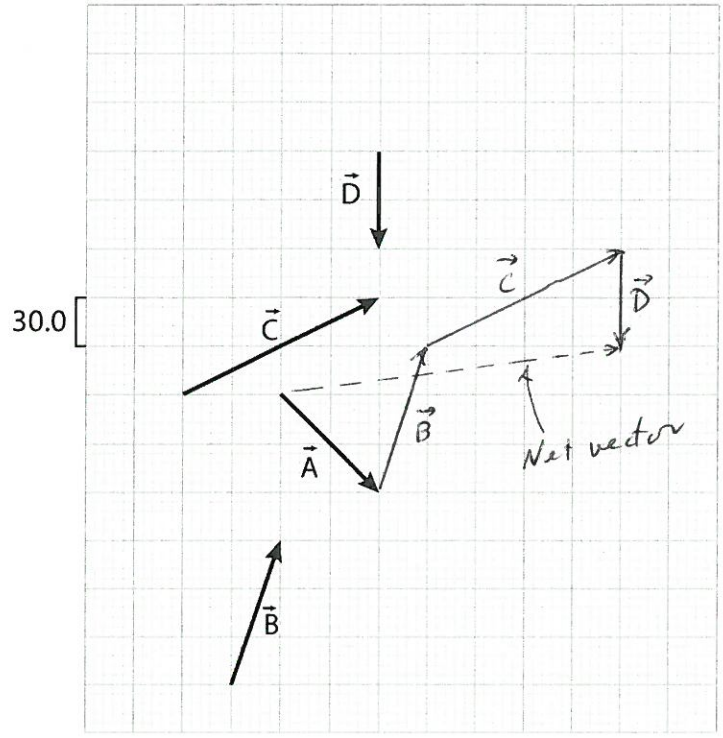
$$B = \sqrt{B_x^2 + B_y^2} = \sqrt{75.5^2 + 6.20^2} = 75.754 \longrightarrow 75.8 \text{ cm}$$

$$\theta = \tan^{-1}\left(\frac{B_y}{B_x}\right) = \tan^{-1}\left(\frac{6.20}{75.5}\right) = 4.6946 \longrightarrow 4.69^\circ$$

(1-a) Answer
$A_x = 2.45$ cm
$A_y = 2.53$ cm
(1-b) Answer
$B = 75.8$ cm
$\theta = 4.69^\circ$

(87%)

(2) Determine the net of the four vectors, $\vec{A}$, $\vec{B}$, $\vec{C}$ and $\vec{D}$ by using the graphical method. Find the magnitude of the net vector.
(Equations)



$(7\times30)^2 +$

$r = 30\sqrt{7^2 + 1^2}$

$= 30 \times 7.071$

$= 212.1 \rightarrow 212$

(2) Answer	Draw inside above.
Magnitude:	212

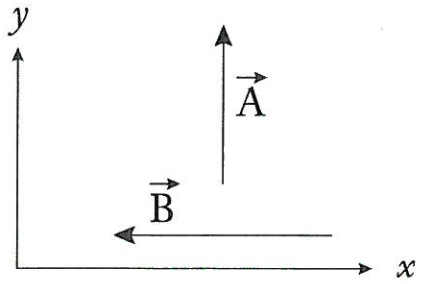
(70 %)

(3) Vector $\vec{A}$ points in the positive y direction and has a magnitude of 13 m. Vector $\vec{B}$ points in the negative x direction and has a magnitude of 34 m.

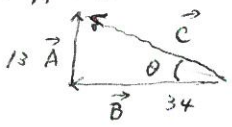
(3-a) Find the direction and magnitude of $\vec{A} + \vec{B}$

(3-b) Find the direction and magnitude of $\vec{A} - \vec{B}$

(3-c) Find the direction and magnitude of $\vec{B} - \vec{A}$



(a) $\vec{C} = \vec{A} + \vec{B}$

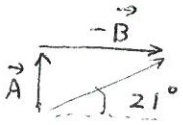


$C = \sqrt{13^2 + 34^2} = 36.4 \longrightarrow 36$

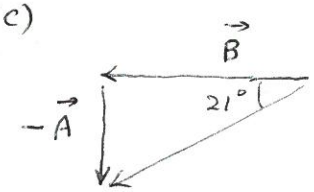
$\theta = \tan^{-1}\left(\frac{13}{34}\right) = 20.9°$ $\quad 180° - 20.9° = 159.1°$

$\longrightarrow 159°$

(b)



(c)

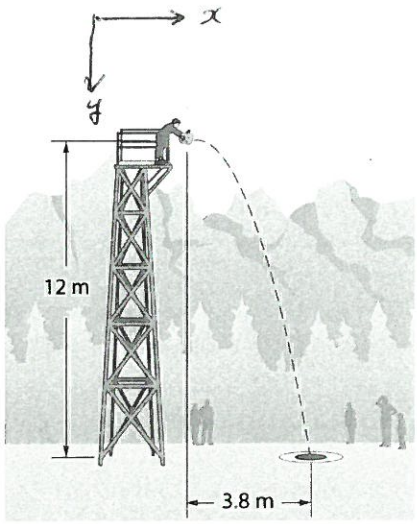


$180° + 21° = 201°$

(3-a) Answer 36 m 159° from positive x
(3-b) Answer 36 m 21° from positive x
(3-c) Answer 36 m 201° from positive x

(51%)

(4) In Denver, after Halloween, children bring their jack-o'-lanterns to the top of a tower and complete for accuracy in hitting a target on the ground, as shown in the figure. Suppose that the tower is 12 m high and that the bull's –eye is a horizontal distance of 3.8 m from the launch point. If the pumpkin is thrown horizontally, what is the launch speed needed to hit the bull's-eye?



$x = v_0 \cdot t$

$y = \frac{1}{2} g t^2$

$\longrightarrow t = \sqrt{\frac{2y}{g}} = \sqrt{\frac{2 \times 12}{9.80}}$

$= 1.565$

$v_0 = \frac{x}{t} = \frac{3.8}{1.565} = 2.428$

$\longrightarrow 2.43\ (m/s)$

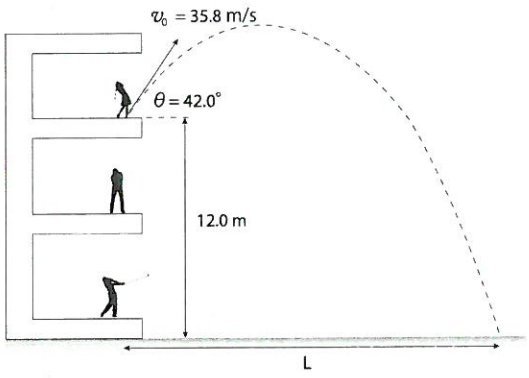
(4) Answer

2.43 m/s

V

(62%)

(5,6) A golfer tees off at an initial speed of 35.8 m/s and at an angle of 42.0° above the horizontal from a height of 12.0 m.
(5-a) What are the horizontal and vertical components of the initial speed?
(5-b) How long does the ball take to reach the highest point?
(6-c) What is the maximum height of the projectile from the ground? The ground is assumed to be flat.
(6-d) What is the speed of the ball just before it hits the ground?
(Equations)



(a) $v_{0x} = 35.8 \cos 42.0^\circ = 26.60 \longrightarrow 26.6$ m/s

$v_{0y} = 35.8 \sin 42.0^\circ = 23.95 \longrightarrow 24.0$ m/s

(b) $v_y = v_{0y} - gt$, $v_y = 0$

$\rightarrow t = \dfrac{v_{0y}}{g} = \dfrac{23.95}{9.80} = 2.444 \longrightarrow 2.44$ s

(c) $v_y^2 - v_{0y}^2 = -2gy$, $v_y = 0$

$y = \dfrac{-23.95^2}{-2 \times 9.80} = 29.27$

$29.27 + 12.0 = 41.27 \longrightarrow 41.3$

(d) $v_x = v_{0x} = 26.60$

$v_y^2 - v_{0y}^2 = -2gy$, $y = -12.0$

$v_y = \sqrt{v_{0y}^2 - 2gy}$

$= \sqrt{23.95^2 - 2 \times 9.80 \times (-12.0)}$

$= \sqrt{808.80} = 28.44$

$v = \sqrt{v_x^2 + v_y^2} = \sqrt{26.60^2 + 28.44^2}$

$= 38.94 \longrightarrow 38.9$ (m/s)

(5-a) Answer	
Horizontal:	26.6 m/s
Vertical	24.0 m/s
(5-b) Answer	
	2.44 s

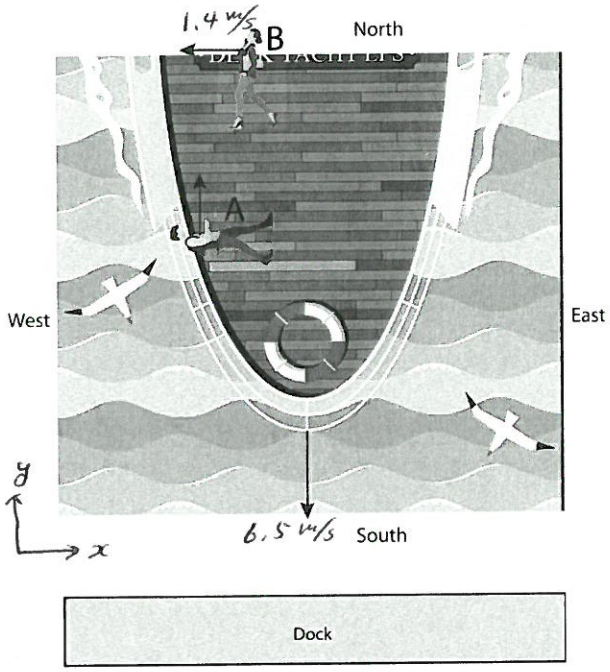
(75%)

(6-c) Answer	
	41.3 m
(6-d) Answer	
	38.9 m/s

(35%)

(7) A ferry approaches shore, moving south with a speed of 6.5 m/s relative to dock. Boy-A on the ferry walks to north with a speed of 1.4 m/s relative to the ferry. What is the velocity (magnitude and direction) of the boy relative to the dock?

(8) On the same ferry, Girl-B walks to west with a speed of 1.4 m/s relative to the ferry. What is the velocity (magnitude and direction) of the girl relative to the dock? (Equations)



(7) $\vec{v}_{PG} = \vec{v}_{PF} + \vec{v}_{FG}$

$= 1.4 + (-6.5)$

$= -5.1$

5.1 m/s to south

(8) $\vec{v}_{PG} = \vec{v}_{PF} + \vec{v}_{FG}$

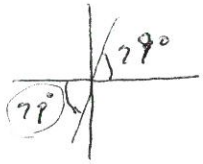
$v_{PGx} = v_{PFx} + v_{FGx} = -1.4 + 0$

$v_{PGy} = v_{PFy} + v_{FGy} = 0 + (-6.5)$

$v_{PG} = \sqrt{v_{PGx}^2 + v_{PGy}^2} = \sqrt{(-1.4)^2 + (-6.5)^2} = 6.649 \rightarrow 6.6$ m/s

$\theta = \tan^{-1}\left(\frac{v_{PGy}}{v_{PGx}}\right) = \tan^{-1}\left(\frac{-6.5}{-1.4}\right)$

$= 77.8° \rightarrow 78°$



78° south of west

(or 12° west of south)

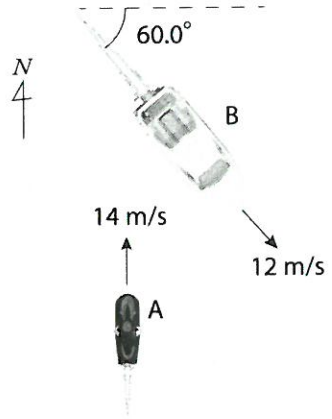
(7) Answer

5.1 m/s to south (70%)

(8) Answer

6.6 m/s to 78° south of west (43%)

(9) On a calm lake a jet ski-A is moving due north at a speed of 14 m/s. A motorboat-B is traveling toward 60.0° south from east at a speed of 12 m/s, as shown in the figure. How does the driver on the jet ski-A experience the velocity (magnitude and direction) of B? (Equations)



$$\vec{v}_{BA} = \vec{v}_B - \vec{v}_A$$

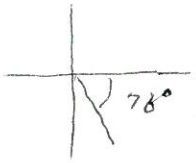
$$\begin{cases} v_{BAx} = v_{Bx} - v_{Ax} = +12\cos 60^\circ - 0 \\ \qquad\qquad = 6.00 \\ v_{BAy} = v_{By} - v_{Ay} = -12\sin 60^\circ - 14 \\ \qquad\qquad = -24.39 \end{cases}$$

$$v_{BA} = \sqrt{v_{BAx}^2 + v_{BAy}^2}$$

$$= \sqrt{6.00^2 + 24.39^2}$$

$$= 25.12 \longrightarrow 25 \quad (m/s)$$

$$\theta = \tan^{-1}\left(\frac{v_{BAy}}{v_{BAx}}\right) = \tan^{-1}\left(\frac{-24.39}{6.00}\right) = -76.2^\circ \longrightarrow -76^\circ$$



(9) Answer

25 m/s

76° south of east

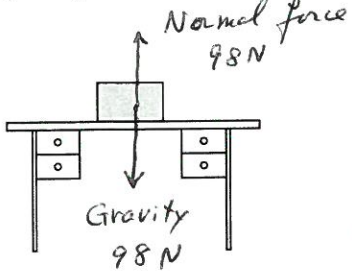
(28%)

(10) In the following figures, a body shown by a rectangle is a mass of **10. kg**, is at rest. Draw all the forces exerted on this body with arrows and write their magnitude and names.

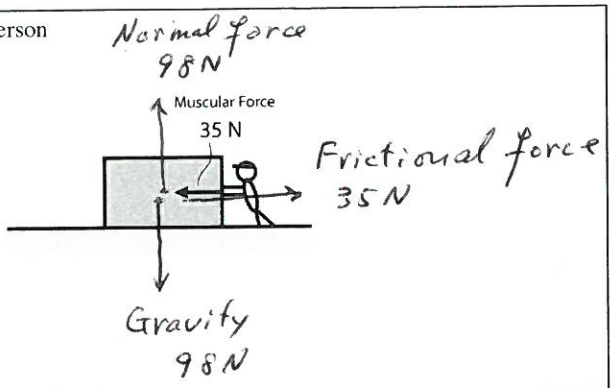
$W = mg = 10 \times 9.8 = 98\ (N)$

(10) Answer
Draw arrows and write the magnitude/names of forces inside the figures.

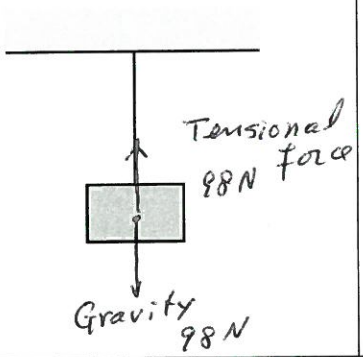
(10-a) Sitting on a desk



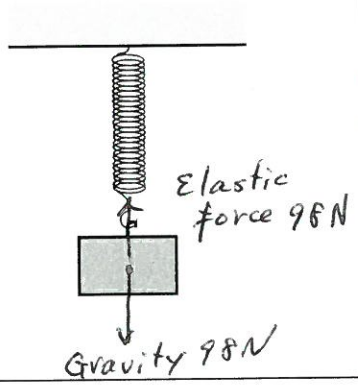
(10-b) Pushed by a person



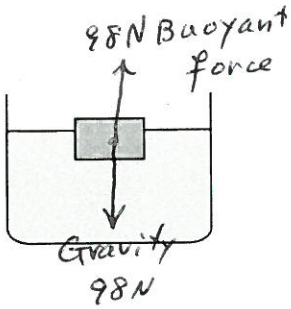
(10-c) Suspended with a string



(10-d) Suspended by a spring



(10-e) Floating on water



(56%)

Your opinions