	Total	KE	IO
Students	32	16	16
Average	32.8/50	31.8/50	34.4/50
Best	48.5/50	48.5/50	46.5/50

11th Physics (2017 – 18)

(1stQ, #2 Mini Test)

Class	No.	Name Solutions

In calculation problems, describe equations clearly and systematically enough to show how to solve the problems.

Gravitational acceleration rate	$g = 9.80\ m/s^2$
Universal Gravitational Constant	$G = 6.67 \times 10^{-11}\ N \cdot m^2/kg^2$
Mass of the Earth	$5.972 \times 10^{24}\ kg$

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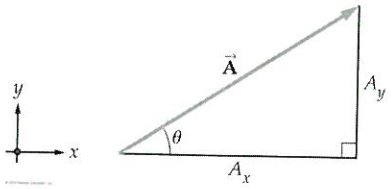
4 pt/question x 13 questions = 52 pt Max 50 pt

／[Total 50 pt]

10/23/2017 *By Tohei Moritani*

Keio Academy of New York

(1) Find A_x and A_y for the vector $\vec{A}$ with magnitude and direction given by A = 3.5 m and $\theta = 66°$, respectively.



(Equations)

$A_x = A\cos 66° = 3.5\cos 66°$

$= 1.42 \longrightarrow 1.4\ (m)$

$A_y = A\sin 66° = 3.5\sin 66°$

$= \quad \longrightarrow \quad (m)$

3.20 3.2

(1) Answer

$A_x = 1.4$ m

$A_y = 3.2$ m

(95%)

(2) Find B and θ for the vector $\vec{B}$ with components B_x = 75.5 m and B_y = 6.20 m.

(Equations)

$B = \sqrt{B_x^2 + B_y^2}$

$= \sqrt{75.5^2 + 6.20^2}$

$= 75.754 \longrightarrow 75.8\ (m)$

$\theta = \tan^{-1}\left(\frac{B_y}{B_x}\right)$

$= \tan^{-1}\left(\frac{6.20}{75.5}\right)$

$= 4.6945 \longrightarrow 4.69$

(2) Answer

$B = 75.8$ m

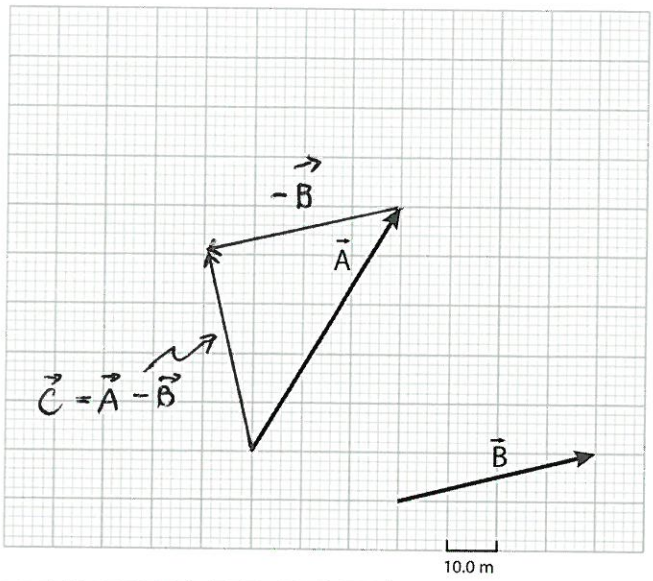
$\theta = 4.69°$

(76%)

(3) For the vectors given in the figure at the right, determine the vector $\vec{C} = \vec{A} - \vec{B}$ by using the graphical method. Find the magnitude of the vector $\vec{C}$.
(Equations)

$C = \sqrt{10.0^2 + 40.0^2}$

$= 41.23 \longrightarrow 41.2\ (m)$



(3) Answer Draw inside above.

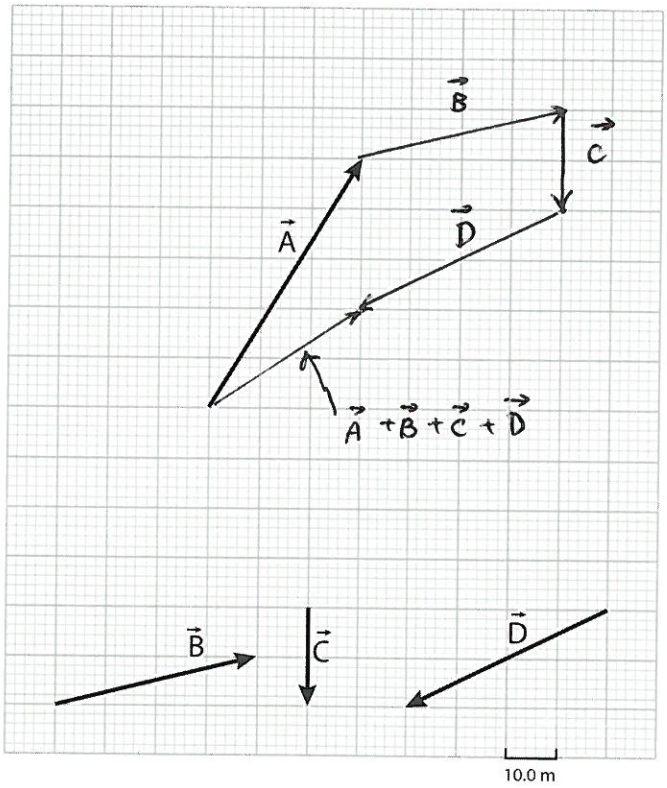
Magnitude: 41.2 m

(58%)

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

$\sqrt{30.0^2 + 20.0^2}$

$= 36.06 \longrightarrow 36.1\ (m)$

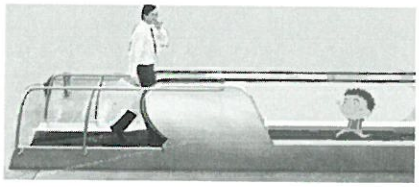


(4) Answer Draw inside above.

Magnitude: 36.1 m

(70%)

(5) There is a moving walkway that has a speed of 2.7 m/s relative to the ground to the north. A kid walks on the walkway to the backward direction at a speed of 2.2 m/s relative to the walkway. What is the velocity (direction and magnitude) of the kid when another person standing on the ground observes?



$\rightarrow x$ (North)

$v_{MG} = 2.7 \ (m/s)$

$v_{KM} = -2.2 \ (m/s)$

$v_{KG} = v_{KM} + v_{MG}$

$= 2.7 + (-2.2)$

$= 0.5 \quad (m/s)$

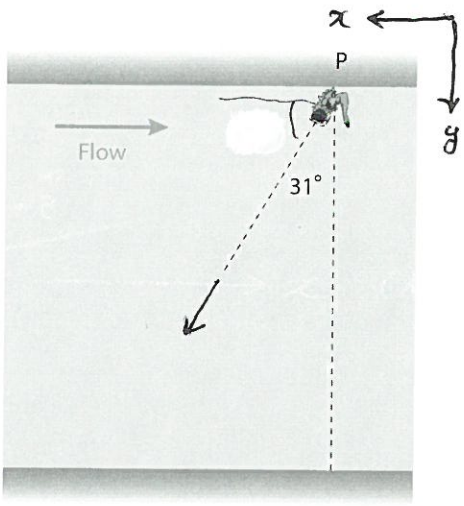
(5) Answer

0.5 m/s to the north

(94%)

to the East

(6) You are swimming at 2.4 m/s relative to water. You point at an angle of 31° upstream on a river flowing 1.6 m/s. What is your velocity (magnitude and direction relative to the ground?



(Equations)

$v = 1.6$ m/s $\begin{cases} v_{WGx} = -1.6 \\ v_{WGy} = 0 \end{cases}$

$v_{PW} = 2.4$ m/s $\begin{cases} v_{PWx} = 2.4\cos 59° \\ v_{PWy} = 2.4\sin 59° \end{cases}$

$$\vec{v}_{PG} = \vec{v}_{PW} + \vec{v}_{WG}$$

$$v_{PGx} = v_{PWx} + v_{WGx}$$
$$= -1.6 + 2.4\cos 59°$$
$$= -0.3639$$

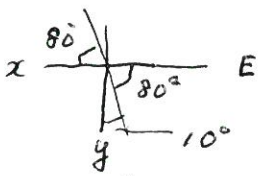
$$v_{PGy} = v_{PWy} + v_{WGy}$$
$$= 2.4\sin 59° + 0$$
$$= 2.057$$

$$v_{PG} = \sqrt{v_{PGx}^2 + v_{PGy}^2}$$
$$= \sqrt{(-0.3639)^2 + (2.057)^2}$$
$$= 2.089 \longrightarrow 2.1 \text{ (m/s)}$$

$$\theta = \tan^{-1}\left(\frac{2.057}{-0.3639}\right) = -79.97°$$

$90.0° - 79.97°$

$= 10.0° \longrightarrow 10°$



(6) Answer

2.1 m/s

10° downstream

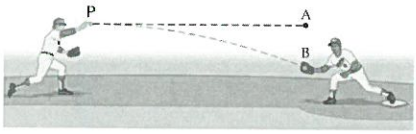
(34%)

(7, 8) You pick up a ball and throw it to second base. The ball is thrown <u>horizontally</u> at point P, with a speed of 21 m/s, directly toward point A. When the ball reaches the second baseman 0.46 s later, it is caught at point B.

7 (8) Find the distance between P and A.

8 (9) Find the distance between A and B.

(Equations)



$x = v_0 t = 21 t$

$= 21 \times 0.46$

$= 9.66 \longrightarrow 9.7 \ (m)$

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

$= \frac{1}{2} \times 9.80 \times 0.46^2$

$= 1.04 \longrightarrow 1.0 \ (m)$

(7) Answer

9.7 m (81%)

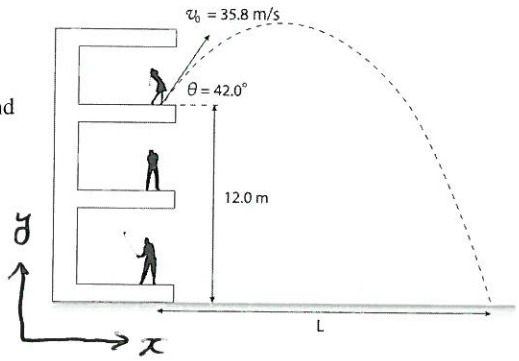
(8) Answer

1.0 m (64%)

(9~11) 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.
(9) How long does the ball take to reach the highest point?

(10) What is the maximum height of the projectile from the ground? The ground is assumed to be flat.

(11) How long does it travel before it hit the ground?
(Equations)



(9) $v_{0x} = v_0 \cos\theta = 35.8 \cos 42.0^\circ$

$= 26.60 \quad (m/s)$

$v_{0y} = v_0 \sin\theta = 35.8 \sin 42.0^\circ$

$= 23.955 \quad (m/s)$

$v_y = v_{0y} - gt \quad , \quad v_y = 0 \qquad t = \frac{v_{0y}}{g} = \frac{23.955}{9.80} = 2.444$

$\longrightarrow 2.44 \ (s)$

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

$-23.955^2 = -2 \times 9.80 \times y \qquad y = \frac{23.955^2}{2 \times 9.80} = 29.28 \ (m)$

$29.28 + 12.0 = 41.28 \longrightarrow 41.3 \ (m)$

(11) $y = v_{0y} t - \frac{1}{2} g t^2$

$-12 = 23.955\, t - 4.90\, t^2$

$t^2 - 4.889\, t - 2.449 = 0$

$t = \frac{4.889 \pm \sqrt{4.889^2 + 4 \times 2.449}}{2}$

$= \frac{4.889 \pm 5.805}{2} = 5.347 \rightarrow 5.35$

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

$4.28 = \frac{1}{2} \times 9.80\, t^2$

$t = 2.902$

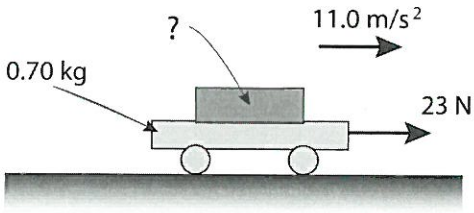
$2.902 + 2.444$

$= 5.346$

$\rightarrow 5.35$

(9) Answer: 2.44 s	(70%)
(10) Answer: 41.3 m	(62%)
(11) Answer: 5.35 s	(43%)

(12) A force of 23 N is acted on a 0.70 kg dynamic cart on a frictionless level surface, where a weight is placed on the cart. If an acceleration of 11.0 m/s^2 is produced, what is the mass of the weight?



(Equations)

$$\Sigma F = m a$$

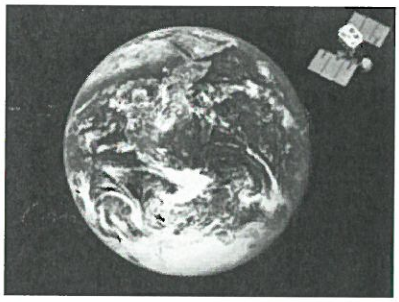
$$23 = (0.70 + m) \times 11.0$$

$$m = \frac{23}{11.0} - 0.70 = 2.09 - 0.70$$

$$= 1.391 \longrightarrow 1.4 \ (kg)$$

(12) Answer: 1.4 kg (68%)

(13) A satellite with a mass of 480 kg is in a circular orbit about the Earth. The radius of the orbit is 35,000 km (3.5 x 10^7 m) as measured from the center of the Earth. Find the gravitational force between the satellite and the Earth.



(Equations)

$$F = G \frac{m_1 m_2}{r^2}$$

$$= 6.67 \times 10^{-11} \times \frac{480 \times 5.972 \times 10^{24}}{(3.5 \times 10^7)^2}$$

$$= \frac{6.67 \times 480 \times 5.972}{3.5^2} \times 10^{-11+24-14}$$

$$= 1561 \times 10^{-1} = 156.1 \longrightarrow 160 \ (N)$$

(13) Answer: 160 N (36%)

Trigonometric Table

角	正弦 (sin)	余弦 (cos)	正接 (tan)
0.0°	0.0000	1.0000	0.0000
0.5°	0.0087	1.0000	0.0087
1.0°	0.0175	0.9998	0.0175
1.5°	0.0262	0.9997	0.0262
2.0°	0.0349	0.9994	0.0349
2.5°	0.0436	0.9990	0.0437
3.0°	0.0523	0.9986	0.0524
3.5°	0.0610	0.9981	0.0612
4.0°	0.0698	0.9976	0.0699
4.5°	0.0785	0.9969	0.0787
5.0°	0.0872	0.9962	0.0875
5.5°	0.0958	0.9954	0.0963
6.0°	0.1045	0.9945	0.1051
6.5°	0.1132	0.9936	0.1139
7.0°	0.1219	0.9925	0.1228
7.5°	0.1305	0.9914	0.1317
8.0°	0.1392	0.9903	0.1405
8.5°	0.1478	0.9890	0.1495
9.0°	0.1564	0.9877	0.1584
9.5°	0.1650	0.9863	0.1673
10.0°	0.1736	0.9848	0.1763
10.5°	0.1822	0.9833	0.1853
11.0°	0.1908	0.9816	0.1944
11.5°	0.1994	0.9799	0.2035
12.0°	0.2079	0.9781	0.2126
12.5°	0.2164	0.9763	0.2217
13.0°	0.2250	0.9744	0.2309
13.5°	0.2334	0.9724	0.2401
14.0°	0.2419	0.9703	0.2493
14.5°	0.2504	0.9681	0.2586
15.0°	0.2588	0.9659	0.2679
15.5°	0.2672	0.9636	0.2773
16.0°	0.2756	0.9613	0.2867
16.5°	0.2840	0.9588	0.2962
17.0°	0.2924	0.9563	0.3057
17.5°	0.3007	0.9537	0.3153
18.0°	0.3090	0.9511	0.3249
18.5°	0.3173	0.9483	0.3346
19.0°	0.3256	0.9455	0.3443
19.5°	0.3338	0.9426	0.3541
20.0°	0.3420	0.9397	0.3640
20.5°	0.3502	0.9367	0.3739
21.0°	0.3584	0.9336	0.3839
21.5°	0.3665	0.9304	0.3939
22.0°	0.3746	0.9272	0.4040
22.5°	0.3827	0.9239	0.4142

角	正弦 (sin)	余弦 (cos)	正接 (tan)
22.5°	0.3827	0.9239	0.4142
23.0°	0.3907	0.9205	0.4245
23.5°	0.3987	0.9171	0.4348
24.0°	0.4067	0.9135	0.4452
24.5°	0.4147	0.9100	0.4557
25.0°	0.4226	0.9063	0.4663
25.5°	0.4305	0.9026	0.4770
26.0°	0.4384	0.8988	0.4877
26.5°	0.4462	0.8949	0.4986
27.0°	0.4540	0.8910	0.5095
27.5°	0.4617	0.8870	0.5206
28.0°	0.4695	0.8829	0.5317
28.5°	0.4772	0.8788	0.5430
29.0°	0.4848	0.8746	0.5543
29.5°	0.4924	0.8704	0.5658
30.0°	0.5000	0.8660	0.5774
30.5°	0.5075	0.8616	0.5890
31.0°	0.5150	0.8572	0.6009
31.5°	0.5225	0.8526	0.6128
32.0°	0.5299	0.8480	0.6249
32.5°	0.5373	0.8434	0.6371
33.0°	0.5446	0.8387	0.6494
33.5°	0.5519	0.8339	0.6619
34.0°	0.5592	0.8290	0.6745
34.5°	0.5664	0.8241	0.6873
35.0°	0.5736	0.8192	0.7002
35.5°	0.5807	0.8141	0.7133
36.0°	0.5878	0.8090	0.7265
36.5°	0.5948	0.8039	0.7400
37.0°	0.6018	0.7986	0.7536
37.5°	0.6088	0.7934	0.7673
38.0°	0.6157	0.7880	0.7813
38.5°	0.6225	0.7826	0.7954
39.0°	0.6293	0.7771	0.8098
39.5°	0.6361	0.7716	0.8243
40.0°	0.6428	0.7660	0.8391
40.5°	0.6494	0.7604	0.8541
41.0°	0.6561	0.7547	0.8693
41.5°	0.6626	0.7490	0.8847
42.0°	0.6691	0.7431	0.9004
42.5°	0.6756	0.7373	0.9163
43.0°	0.6820	0.7314	0.9325
43.5°	0.6884	0.7254	0.9490
44.0°	0.6947	0.7193	0.9657
44.5°	0.7009	0.7133	0.9827
45.0°	0.7071	0.7071	1.0000

角	正弦 (sin)	余弦 (cos)	正接 (tan)
45.0°	0.7071	0.7071	1.0000
45.5°	0.7133	0.7009	1.0176
46.0°	0.7193	0.6947	1.0355
46.5°	0.7254	0.6884	1.0538
47.0°	0.7314	0.6820	1.0724
47.5°	0.7373	0.6756	1.0913
48.0°	0.7431	0.6691	1.1106
48.5°	0.7490	0.6626	1.1303
49.0°	0.7547	0.6561	1.1504
49.5°	0.7604	0.6494	1.1708
50.0°	0.7660	0.6428	1.1918
50.5°	0.7716	0.6361	1.2131
51.0°	0.7771	0.6293	1.2349
51.5°	0.7826	0.6225	1.2572
52.0°	0.7880	0.6157	1.2799
52.5°	0.7934	0.6088	1.3032
53.0°	0.7986	0.6018	1.3270
53.5°	0.8039	0.5948	1.3514
54.0°	0.8090	0.5878	1.3764
54.5°	0.8141	0.5807	1.4019
55.0°	0.8192	0.5736	1.4281
55.5°	0.8241	0.5664	1.4550
56.0°	0.8290	0.5592	1.4826
56.5°	0.8339	0.5519	1.5108
57.0°	0.8387	0.5446	1.5399
57.5°	0.8434	0.5373	1.5697
58.0°	0.8480	0.5299	1.6003
58.5°	0.8526	0.5225	1.6319
59.0°	0.8572	0.5150	1.6643
59.5°	0.8616	0.5075	1.6977
60.0°	0.8660	0.5000	1.7321
60.5°	0.8704	0.4924	1.7675
61.0°	0.8746	0.4848	1.8040
61.5°	0.8788	0.4772	1.8418
62.0°	0.8829	0.4695	1.8807
62.5°	0.8870	0.4617	1.9210
63.0°	0.8910	0.4540	1.9626
63.5°	0.8949	0.4462	2.0057
64.0°	0.8988	0.4384	2.0503
64.5°	0.9026	0.4305	2.0965
65.0°	0.9063	0.4226	2.1445
65.5°	0.9100	0.4147	2.1943
66.0°	0.9135	0.4067	2.2460
66.5°	0.9171	0.3987	2.2998
67.0°	0.9205	0.3907	2.3559
67.5°	0.9239	0.3827	2.4142

角	正弦 (sin)	余弦 (cos)	正接 (tan)
67.5°	0.9239	0.3827	2.4142
68.0°	0.9272	0.3746	2.4751
68.5°	0.9304	0.3665	2.5386
69.0°	0.9336	0.3584	2.6051
69.5°	0.9367	0.3502	2.6746
70.0°	0.9397	0.3420	2.7475
70.5°	0.9426	0.3338	2.8239
71.0°	0.9455	0.3256	2.9042
71.5°	0.9483	0.3173	2.9887
72.0°	0.9511	0.3090	3.0777
72.5°	0.9537	0.3007	3.1716
73.0°	0.9563	0.2924	3.2709
73.5°	0.9588	0.2840	3.3759
74.0°	0.9613	0.2756	3.4874
74.5°	0.9636	0.2672	3.6059
75.0°	0.9659	0.2588	3.7321
75.5°	0.9681	0.2504	3.8667
76.0°	0.9703	0.2419	4.0108
76.5°	0.9724	0.2334	4.1653
77.0°	0.9744	0.2250	4.3315
77.5°	0.9763	0.2164	4.5107
78.0°	0.9781	0.2079	4.7046
78.5°	0.9799	0.1994	4.9152
79.0°	0.9816	0.1908	5.1446
79.5°	0.9833	0.1822	5.3955
80.0°	0.9848	0.1736	5.6713
80.5°	0.9863	0.1650	5.9758
81.0°	0.9877	0.1564	6.3138
81.5°	0.9890	0.1478	6.6912
82.0°	0.9903	0.1392	7.1154
82.5°	0.9914	0.1305	7.5958
83.0°	0.9925	0.1219	8.1443
83.5°	0.9936	0.1132	8.7769
84.0°	0.9945	0.1045	9.5144
84.5°	0.9954	0.0958	10.385
85.0°	0.9962	0.0872	11.430
85.5°	0.9969	0.0785	12.706
86.0°	0.9976	0.0698	14.301
86.5°	0.9981	0.0610	16.350
87.0°	0.9986	0.0523	19.081
87.5°	0.9990	0.0436	22.904
88.0°	0.9994	0.0349	28.636
88.5°	0.9997	0.0262	38.188
89.0°	0.9998	0.0175	57.290
89.5°	1.0000	0.0087	114.59
90.0°	1.0000	0.0000	– – –

Square and Square Root Table

n	n^2	$\sqrt{n}$
1	1	1.0000
2	4	1.4142
3	9	1.7321
4	16	2.0000
5	25	2.2361
6	36	2.4495
7	49	2.6458
8	64	2.8284
9	81	3.0000
10	100	3.1623

Your opinions