College of Arts and Sciences
Department of Mathematics, Statistics, and Physics
Physics Program
Instructors: Drs. D. Al-Abdulmalik and H. Merabet

100

Name……
Student ID……List No……
Section:……

General Physics for Engineers I
PHYS 191 Fall 2012 (all sections)
(PHYS 101 all sections)
Exam 1
October 20, 2012

Please read the following instructions carefully before you start answering:

1. Make sure that you have 9 pages including two parts, A and B. Part A consists of 8 multiple choice questions, while Part B consists of 3 problems.
2. Answer all the questions and show all the steps of your work in a clear tidy way.
3. Calculators are permitted but no electronic dictionaries or mobiles.
4. Include units in all calculations and answers.
5. All your work must be done on your exam paper; no loose papers are allowed. If additional space is required use the last page and indicate that this has been done.
6. This is a timed exam (100 min). Do not spend too much time in any particular question.

Useful Information:

$$\begin{cases} V_x = V\cos\theta \\ V_y = V\sin\theta \end{cases} \qquad V = \sqrt{V_x^2 + V_y^2} \quad \text{and} \quad \tan\theta = \frac{V_y}{V_x}$$

TABLE 3–1 Kinematic Equations for Constant Acceleration in 2 Dimensions

x Component (horizontal)		*y* Component (vertical)
$v_x = v_{x0} + a_x t$	(Eq. 2–12a)	$v_y = v_{y0} + a_y t$
$x = x_0 + v_{x0}t + \frac{1}{2}a_x t^2$	(Eq. 2–12b)	$y = y_0 + v_{y0}t + \frac{1}{2}a_y t^2$
$v_x^2 = v_{x0}^2 + 2a_x(x - x_0)$	(Eq. 2–12c)	$v_y^2 = v_{y0}^2 + 2a_y(y - y_0)$

$$\Delta\vec{\mathbf{r}} = (x_2 - x_1)\hat{\mathbf{i}} + (y_2 - y_1)\hat{\mathbf{j}} + (z_2 - z_1)\hat{\mathbf{k}}$$

$$\vec{\mathbf{v}} = \vec{\mathbf{v}}_0 + \vec{\mathbf{a}}t$$

$$\vec{\mathbf{r}} = \vec{\mathbf{r}}_0 + \vec{\mathbf{v}}_0 t + \tfrac{1}{2}\vec{\mathbf{a}}t^2$$

g= 9.80 m/s^2

$$\vec{\mathbf{v}} = \frac{d\vec{\mathbf{r}}}{dt} \qquad \vec{\mathbf{a}} = \frac{d\vec{\mathbf{v}}}{dt} \qquad \Sigma\vec{\mathbf{F}} = m\vec{\mathbf{a}}$$

Good Luck

Part A: *Please choose the correct answer for each question and justify your choice in the space provided.*

Question 1: (6 pts) Power is defined as the rate of work per time, power = work/time. If the dimensions of power are $[ML^2T^{-3}]$, what are the dimensions of work?

(a) $[MLT^{-3}]$

(b) $[ML^2T^{-1}]$

(c) $[ML^3T^{-3}]$

(d) $[ML^2T^{-2}]$

(e) $[ML^2T^{-4}]$

Justification:

Question 2: (6 pts) What is 56 + (32.00)/(1.2465 + 3.45) written with the correct number of significant figures?

(a) 62.8

(b) 62.812

(c) 62.81

(d) 63

(e) 62.8123846

Justification:

Question 3: (6 pts) Fig. 1 shows the position of an object as a function of time. During which time interval is the object at rest between 0.0 s and 9.0 s?

(a) The object is at rest between 6.0 s and 9.0 s.

(b) The object is always at rest except at the instants t = 3.0 s and t = 6.0 s.

(c) The object is at rest between 0.0 s and 3.0 s.

(d) The object is at rest between 3.0 s and 6.0 s.

(e) The object is never at rest.

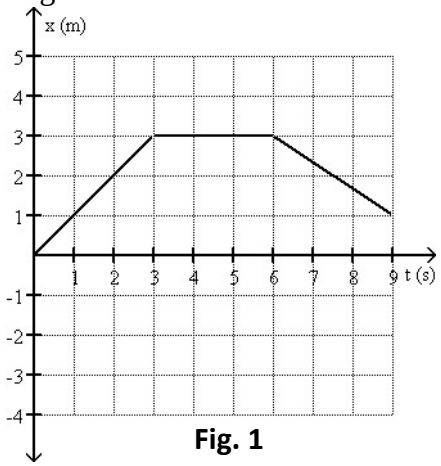


Fig. 1

Justification:

Question 4: (6 pts) The acceleration of an object as a function of time is given by $a(t) = (3.00\, m/s^3)t$. If the object is at rest at time t = 0.00 s, what is the velocity of the object at time t = 5.00 s?

(a) 15.0 m/s
(b) 37.5 m/s
(c) 0.00 m/s
(d) 12.0 m/s
(e) 75.0 m/s

Justification:

Question 5: (6 pts) A rock is dropped from a vertical cliff. The rock takes 3.00 s to reach the ground below the cliff. A second rock is thrown vertically downward from the cliff and takes 2.00 s to reach the ground below the cliff from the time it is released. With what velocity was the second rock released?

(a) 4.76 m/s upward
(b) 5.51 m/s downward
(c) 12.2 m/s upward
(d) 4.76 m/s downward
(e) 12.2 m/s downward

Justification:

Question 6: (6 pts) Refer to Fig. 2. The components of vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ are

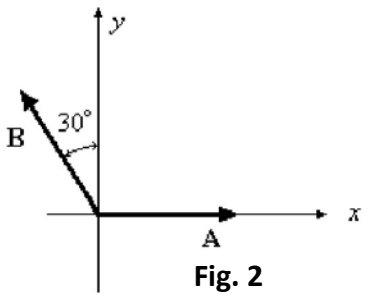


Fig. 2

(a) $A_x = 0$	$B_x = B \sin 30°$	$A_y = 0$	$B_y = B \cos 30°$.
(b) $A_x = A \sin 90°$	$B_x = B \cos 60°$	$A_y = A \cos 90°$	$B_y = B \sin 60°$.
(c) $A_x = A \cos 0°$	$B_x = -B \cos 60°$	$A_y = A \cos 90°$	$B_y = B \cos 30°$.
(d) $A_x = A \cos 90°$	$B_x = B \sin 60°$	$A_y = A \sin 90°$	$B_y = B \cos 60°$.
(e) $A_x = A \cos 90°$	$B_x = 0$	$A_y = A \sin 90°$	$B_y = 0$.

Justification:

Question 7: (6 pts) A child throws a ball with an initial speed of 8.00 m/s at an angle of 40.0° above the horizontal. The ball leaves her hand 1.00 m above the ground. How far from where the child is standing does the ball hit the ground?

(a) 1.22 m
(b) 5.14 m
(c) 6.79 m
(d) 7.48 m
(e) 1.58 m

Justification:

Question 8: (6 pts) An object is moving with constant velocity in a straight line. Which of the following statements is true?

(a) A constant force is being applied in the direction of motion.
(b) A constant force is being applied in the direction opposite of motion.
(c) There are no forces acting on the object.
(d) The net force on the object is zero.
(e) There is no frictional force acting on the object.

Justification:

Extra Space below in case you need it

Part B: *Please solve the following problems showing all the steps of your solution.*

Problem 1: (20 pts)

A motorist drives along a straight road at a constant speed of 20.0 m/s. Just as she passes a parked motorcycle police officer, the officer starts to accelerate at 2.50 m/s^2 to overtake her. Assuming the officer maintains this acceleration:

(a) List the given and wanted quantities and draw a sketch. (5 pts)

(b) Determine the time it takes the police officer to reach the motorist. (5 pts)

(c) Find the speed of the officer as he overtakes the motorist. (5 pts)

(d) Find the total displacement of the officer as he overtakes the motorist. (5 pts)

Problem 2: **(16 pts)**

The position of a particular particle as a function of time is given by $\vec{\mathbf{r}} = \left(9.50t\hat{\mathbf{i}} + 8.75\hat{\mathbf{j}} - 1.00t^2\hat{\mathbf{k}}\right)$ m.

(a) Determine the particle's velocity and acceleration as a function of time. (6 pts)

(b) What is the average velocity of the particle between t = 1.00 s and t = 3.00 s? (5 pts)

(c) What is the magnitude of the instantaneous velocity at t = 2.00 s? (5 pts)

Problem 3: **(16 pts)**

A high diver leaves the end of a 6.0 m-high diving board and strikes the water 1.6 s later, $x_f = 3.0$ m beyond the end of the board. Take $y_0 = 0$ at the level of the water. Determine:

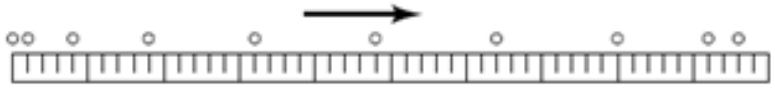
(a) the diver initial velocity, $\vec{\mathbf{v}}_\mathbf{o}$. (6 pts)

(b) the maximum height, h_{max}, reached by the diver. (5 pts)

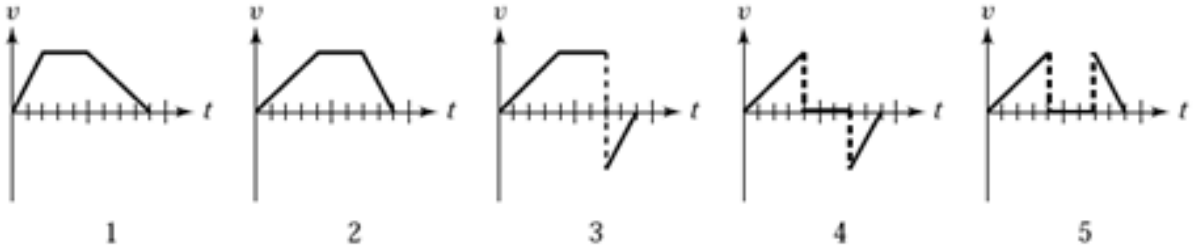
(c) the velocity $\vec{\mathbf{v}}_\boldsymbol{f}$ with which the diver enters the water. (5 pts)

Extra Credit Question: **(5 pts)**

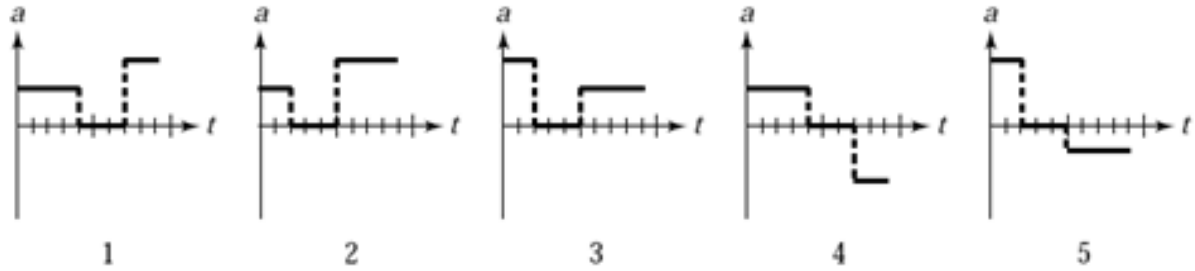
The diagram below represents a multi-flash photograph of an object moving along a horizontal surface. The positions indicated in the diagram are separated by equal time intervals. The first flash occurred just as the object started to move and the last just as it came to rest.



(a) Which of the graphs 1-5 below best represents the object's velocity as a function of time?



(b) Which of the graphs 1-5 below best represents the object's acceleration as a function of time?



Justification:

End of Exam

Extra Space below in case you need it

College of Arts and Sciences
Department of Mathematics, Statistics, and Physics
Physics Program

جامعة قطر
QATAR UNIVERSITY

General Physics for Engineering I
PHYS 191
Fall 2013

26th Oct. 2013

EXAM (1)

Instructors: **Dr. A. Shalaby, Dr. L. Al-Sulaiti, Dr. M. Al-Muraikhi , and Dr. K. Al-Qadi**

Student Name: _____

Student ID: _____

Section number: _____

	20

Please read the following instructions carefully before you start answering

1. Make sure that you have 6 pages including two parts, A and B. Part A consists of 9 multiple choice questions, and part B consists of 3 problems.
2. Calculators are permitted but **no electronic dictionaries or mobile phones**.
3. All your work must be done on your exam paper; no loose papers are allowed.
4. This is a timed exam (120 min). *Do not spend too much time on any particular question.*

With our Best Wishes

Part A. Please choose the one alternative that best completes the statement or answers the question and indicate your choice using *pen* in the *space provided.* 9

Make sure that only ONE of the alternatives is chosen for each question. Two answers to one question will result in loss of the mark of that question.

1. What is the cosine of 45°? "Apply significant figure rules" 1. _____
A) 0.7 B) 0.71 C) 0.707 D) 0.7071 E) 0.70710

2. What is the product of 12.56 and 2.12? "Apply significant figure rules" 2. _____
A) 27 B) 26.6 C) 26.23 D) 26.627 E) 26.6270

3. The position, x, of an object is given by the equation $x = A + Bt + Ct^2$, where t refers to time. What are the dimensions of A, B, and C? 3. _____
A) distance, distance, distance
B) distance, time, time
C) distance, time, time^2
D) distance, distance/time, distance/ time^2
E) distance/time, distance/time^2, distance/ time^3

4. Suppose that a car traveling to the West (-x direction) begins to slow down as it approaches a traffic light. Make a statement concerning its acceleration. 4. _____
A) The car is decelerating, and its acceleration is positive.
B) The car is decelerating, and its acceleration is negative.
C) The acceleration is zero.
D) The car is accelerating, and its acceleration is positive.

5. A moving particle is accelerating from rest with the rate of $2\,^{m}/_{S^2}$. The particle displacement in the first 10 seconds is: 5. _____
A) 20 m B) -20 m C) 100 m D) 75 m
E) Not enough information to determine the particle displacement.

6. The figure 1 shows the position of an object as a function of time. What is the displacement of the object between time intervals $t = 0$ *and* $t = 11\,S$? 6. _____
A) 3 m B) 4 m C) 14 m D) 1 m E) -1 m

7. The components of vectors $\vec{A}$ *and* $\vec{B}$ in the figure are: 7. _____
A) $A_x = 0$ $B_x = B \sin 30°$ $A_y = 0$ $B_y = B \cos 30°$.
B) $A_x = A \sin 90°$ $B_x = B \cos 60°$ $A_y = A \cos 90°$ $B_y = B \sin 60°$.
C) $A_x = A \cos 0°$ $B_x = -B \cos 60°$ $A_y = A \cos 90°$ $B_y = B \cos 30°$.
D) $A_x = A \cos 90°$ $B_x = B \sin 60°$ $A_y = A \sin 90°$ $B_y = B \cos 60°$.
E) $A_x = A \cos 90°$ $B_x = 0$ $A_y = A \sin 90°$ $B_y = 0$

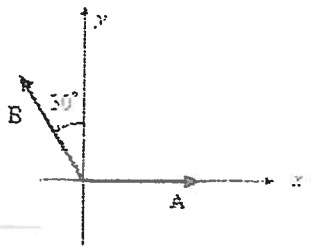
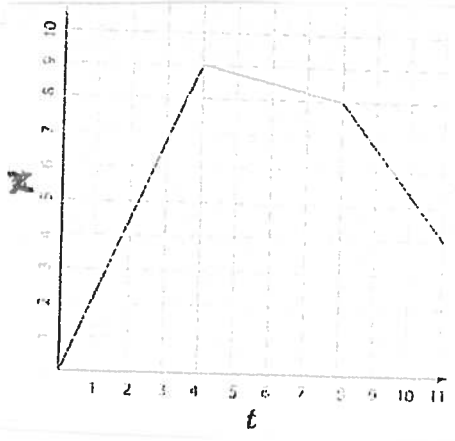
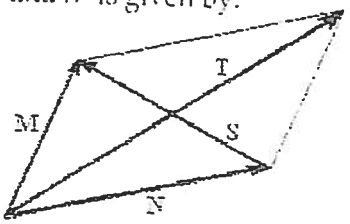


Figure-1



8. Vector $\vec{S}$ as expressed in terms of vectors $\vec{M}$ and $\vec{N}$ is given by: 8. _____

a) $\vec{S} = \vec{M} - \vec{N}$
b) $\vec{S} = \vec{M} + \vec{N}$
c) $\vec{S} = \vec{M} - \vec{T}$
d) $\vec{S} = \vec{T} + \vec{N}$
e) None of the other choices is correct.



9. Vector $\vec{V}$ has the components $\vec{V_x} = 12.0\ m$ and $\vec{V_y} = 5.00\ m$. What is the magnitude of $\vec{V}$, and what is angle that vector $\vec{V}$ makes with the x-axis? 9. _____

A) 5.70 m, 22.6° B) 13.0 m, 22.6° C) 17.0 m, 32.6° D) 13.0 m, 67.4°

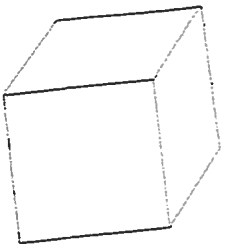
PROBLEMS:

PROBLEM (1) 2 marks

2

A student measured the dimensions of a parallelepiped as $l = 11.10\ cm$, and $w = 5.0518\ cm$, the height is unknown. The density of the object is $d = \frac{m}{V}$, where m is the mass, and V is the volume. The measured mass is $m = 390.4\ g$, and the density is $d = 2.70\ \frac{g}{cm^3}$. Calculate the following: *"take into account significant figures rules and units"*

A) Calculate the area of the object $A = l \times w$
B) Using the given density value, calculate the volume of the object
C) If the volume of the object is $V = l \times w \times h$, then calculate the unknown height.
D) Present the calculated height in S.I. untis.



PROBLEM (2) 4 marks

4

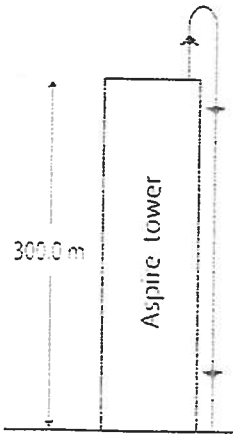
A lucky student has a chance to do an experiment at the top of the Aspire tower. which is 300.0 m high above the ground. He kicked a ball vertically up. When he measured the initial velocity of the ball it was 28.2 $^{m}/_{s}$. After some time the ball hits the ground. Neglect air resistence and the rotation of the ball.

A) Calculate the maximum height the ball can reach with respect to the ground.

B) Calculate the time required for the ball to reach a height of 200.0 m above the ground.

C) Calculate the total time of the trip.

D) Calculate the speed of the ball when it hits the ground.



PROBLEM (3) 5 marks

The displacement vector of a ball kicked at ground level is $\vec{x}(t) = (16.1t)\hat{\imath} + (28.7t)\hat{\jmath}$, where x in meters and t in seconds.

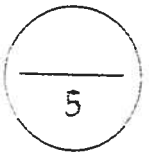
A) Find the initial velocity of the ball. What is the angle of the velocity with respect to the horizontal?

B) Calculate the total time of the trip for the ball.

C) Calculate the maximum height the ball can reach.

D) Calculate the maximum horizontal distance the ball can travel.

E) At what time, during the trip, the ball reaches a vertical height of 5.65 m?



Useful Formulae

$$x = \frac{v_0^2 \sin(2\theta)}{g}$$

$$v = v_0 + at$$

$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

$$\bar{v} = \frac{v + v_0}{2}.$$

If $ax^2 + bx + c = 0$

Then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

College of Arts and Science
Department of Mathematics, Statistics and Physics
Physics program

General Physics for Engineering I PHYS191
General Physics I Phys 101
Spring 2013

EXAM 1 24th March 2014

Instructors
Dr. L. Al-Sulaiti, Dr M. Al-Muraikhi, Dr K. Al-Qadi, Dr. M. Zayed

Students name: _____

Students ID: _____

Section number:_____

Please read those instructions carefully:

- Make sure you have 6 pages after the cover page, including 2 parts A and B. Part A consist of 12 multiple choice questions where you select only one of the proposed answers. Part B consist of 3 problems that you have to solve.
- Calculators are permitted, but no electronic dictionaries and mobile phones are strictly forbidden.
- All work must be done on exam paper, no loose paper are allowed.
- This is a timed exam (120 minutes). Manage your time and do not spend too much time on any particular question.

Useful formulas

Constant acceleration in 2D:

x Component (horizontal)		*y* Component (vertical)
$v_x = v_{x0} + a_x t$	(Eq. 2–12a)	$v_y = v_{y0} + a_y t$
$x = x_0 + v_{x0} t + \frac{1}{2} a_x t^2$	(Eq. 2–12b)	$y = y_0 + v_{y0} t + \frac{1}{2} a_y t^2$
$v_x^2 = v_{x0}^2 + 2a_x(x - x_0)$	(Eq. 2–12c)	$v_y^2 = v_{y0}^2 + 2a_y(y - y_0)$

Quadratic equation:

If $ax^2 + bx + c = 0$

then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Part A. MULTIPLE CHOICE
Choose one answer that best completes the statement or answers the question.
Indicate your choice using pen in the space provided.

Choose only ONE answer. You don't need to give justification.
More than one answer will result in loosing all the marks of that question.
Each question is 1 point.

1) What is 56 + (32.00)/(1.2465 + 3.45) written with the correct number of significant figures?
A) 62.81
B) 62.812
C) 62.8123846
D) 62.8
E) 63

2) What is the conversion factor between km/h and m/s?
A) 2.78×10^{-1} (m/s)/(km/h)
B) 3.60 (m/s)/(km/h)
C) 16.7 (m/s)/(km/h)
D) 7.72×10^{-5} (m/s)/(km/h)
E) 1.30×10^{4} (m/s)/(km/h)

3) Power is defined as the rate of work per time, power = work/time. If the dimensions of power are $[ML^2T^{-3}]$, what are the dimensions of work?
A) $[ML^2T^{-2}]$ B) $[ML^2T^{-4}]$ C) $[MLT^{-3}]$ D) $[ML^3T^{-3}]$ E) $[ML^2T^{-1}]$

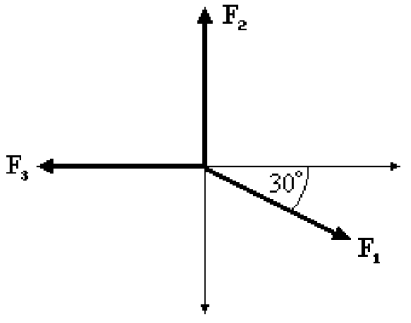
4) A rock is dropped from a vertical cliff. The rock takes 7.00 s to reach the ground below the cliff. What is the height of the cliff?
A) 100 m B) 80.1 m C) 481 m D) 26.2 m E) 240 m

5) Two objects are thrown from the top of a tall building. One is thrown up, and the other is thrown down, both with the same initial speed. What are their speeds when they hit the street?
A) The one thrown down is traveling faster.
B) They are traveling at the same speed.
C) The one thrown up is traveling faster.
D) It is impossible to tell because the height of the building is not given.
E) It is impossible to tell because a numerical value for the initial speed is not given.

6) Vector $\vec{C} = \vec{A} + \vec{B}$. Under what condition is $|\vec{C}|^2 = |\vec{A}|^2 + |\vec{B}|^2$?
A) Vectors $\vec{A}$ and $\vec{B}$ are in perpendicular directions.
B) The statement is always true.
C) The statement is never true.
D) Vectors $\vec{A}$ and $\vec{B}$ are in opposite directions.
E) Vectors $\vec{A}$ and $\vec{B}$ are in the same direction.

7) A pilot drops a bomb from a plane flying horizontally at a constant speed. Neglecting air resistance, when the bomb hits the ground the horizontal location of the plane will
A) be over the bomb.
B) be in front of the bomb.
C) depend of the mass of the bomb when it was released.
D) be behind the bomb.
E) depend of the speed of the plane when the bomb was released.

FIGURE 1



8) Refer to Figure 1 The magnitudes of the forces as shown in the figure are: F_1 = 80.0 N, F_2 = 60.0 N, and F_3 = 40.0 N. The resultant force acting on the particle O is given by
A) 60.0 N at an angle 90.0° with respect to +*x*-axis.
B) 180 N at an angle 60.0° with respect to +*x*-axis.
C) 20.0 N at an angle 34.3° with respect to +*x*-axis.
D) 40.0 N at an angle 60.0° with respect to +*x*-axis.
E) 35.5 N at an angle 34.3° with respect to +*x*-axis.

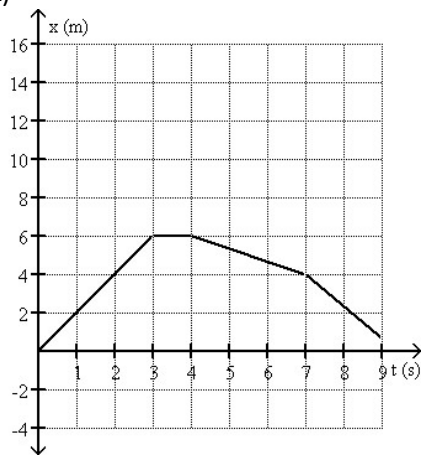
9) An object is moving with constant velocity in a straight line. Which of the following statements is true?
A) There are no forces acting on the object.
B) A constant force is being applied in the direction of motion.
C) There is no frictional force acting on the object.
D) The net force on the object is zero.
E) A constant force is being applied in the direction opposite of motion.

10) Two objects push away each other. The first object has a mass 30.0 kg and it accelerates at 2.00 m/s^2 toward the east. The second object has a mass 7.00 kg. If no other forces are acting on the objects, what is the acceleration of the second object?
A) 4.67 m/s^2 west
B) 4.67 m/s^2 east
C) 1.14 m/s^2 east
D) 8.57 m/s^2 west
E) 2.00 m/s^2 west

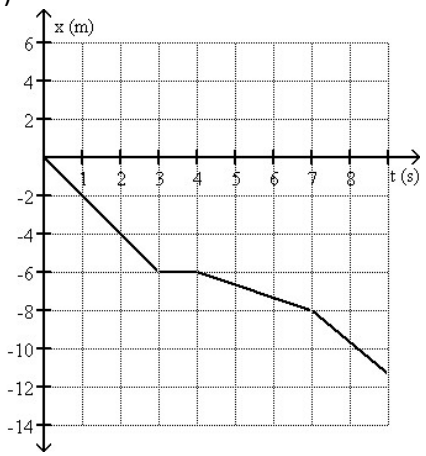
11) Starting from rest, a 4.0-kg body reaches a speed of 8.0 m/s in 2.0 s. What is the net force acting on the body?
A) 4.0 N B) 2.0 N C) 16 N D) 8.0 N E) 32 N

12) Which graph below could represent the motion of the object described in the following sentences? The object that starts its motion with a constant velocity of 2.0 m/s east. After 3.0 s, the object stops for 1.0 s. The object then moves toward the west a distance of 2.0 m in 3.0 s. The object continues travelling in the same direction, but increases its speed by 1.0 m/s for the next 2.0 s.

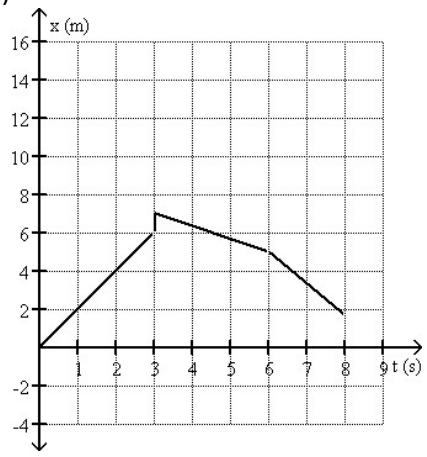
A)



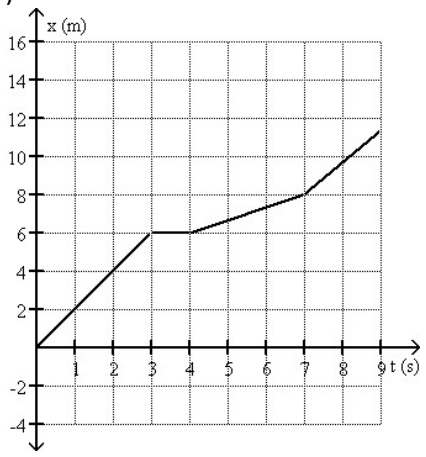
B)



C)



D)



E) None of the above graphs could represent the motion described

Part B. Problems

Instructions: Solve the problems given**. Present a clear work**. Solve symbolically first draw a box around your symbolic answer. Do the numerical application afterwards and draw a box around your numerical answer. You must give the unit of your numerical answer.

Problem 1. (3pts)

A sphere has mass M = 913 g and a radius of R = 124.3 mm.
The relation between the volume V and the radius R of a sphere is: $V = \frac{4}{3}\pi R^3$
The density is given by $\frac{M}{V}$.

Applying the rules for significant figures,

a) calculate the volume of the sphere in mm^3
b) calculate the density of the sphere in units of g/mm^3.
c) express this density in the standard SI units using scientific notation.

Problem 2. (5pts)

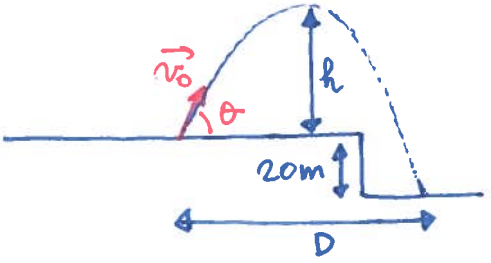
A ball is hit straight up into the air with a speed of 30.0 m/s from ground level.

a) Calculate the time the ball is in the air.
b) Calculate the height that the ball reached after 3.06s.
c) Determine the time at which the ball passes 25.0 m above the ground level.
d) Explain why there are two answers to part c.

Problem 3. (5pts)

A projectile is fired from ground level with an initial speed v_0 = 72.3 m/s at an angle θ =69.2° above the horizontal.

(a) Calculate the time necessary for the projectile to reach its maximum height.
(b) Calculate the maximum height *h* reached by the projectile.
(c) Calculate the horizontal and vertical components of the velocity vector at the maximum height.
(d) Calculate horizontal distance D travelled by projectile, if the landing point is 20 m below the starting ground level.
(e) Calculate the magnitude of the velocity at that landing point, and the angle it makes with the horizontal.



College of Arts and Sciences
Department of Mathematics, Statistics, and Physics
Physics Program
Instructors: Dr. Maitha Al-Muraikhi, Dr. Hocine Merabet, Dr. Mohammad Gharaibeh, and Dr. Ahmad Ayesh

20

Name:.....
Student ID: ..... List Number: .....
Section:.....

Physics for Engineers I (PHYS 191)
and
General Physics I (PHYS 101)
Fall 2015
Exam 1
November 3, 2015

Please read the following instructions carefully before you start answering:

1. Make sure that you have **7** pages including two parts, A and B. Part A consists of 12 multiple choice questions, while Part B consists of 3 problems.
2. Answer all the questions and show all the steps of your work in part B in a clear tidy way.
3. Calculators are permitted but no electronic dictionaries.
4. Include units in all calculations and answers.
5. All your work must be done on your exam paper; no loose papers are allowed. If additional space is required use the last page and indicate that this has been done.
6. This is a timed exam (120 min). Do not spend too much time in any particular question.

Useful Information:

$\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, $\vec{v}_{av} = \frac{\Delta\vec{r}}{\Delta t}$, $\vec{v} = \lim_{\Delta t\to 0}\frac{\Delta\vec{r}}{\Delta t} = \frac{d\vec{r}}{dt}$, $\vec{a}_{av} = \frac{\Delta\vec{v}}{\Delta t}$, $\vec{a} = \lim_{\Delta t\to 0}\frac{\Delta\vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}$

$v_x = v_{0x} + a_x t$, $x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$, $v_x^2 = v_{0x}^2 + 2a_x(x - x_0)$, $x - x_0 = \left(\frac{v_{0x}+v_x}{2}\right)t$

$v_x = v_{0x} + \int_0^t a_x\, dt$, $x = x_0 + \int_0^t v_x\, dt$, $a_{rad} = \frac{v^2}{R}$; g = 9.80 m/s^2

Good Luck

Part A: *Please choose the correct answer for each question*

Question 1: **(1 pt)** What is the result of 1.58 ÷ 3.793 written with the correct number of significant figures?

A) 4.1656×10^{-1}
B) 4.166×10^{-1}
C) 4.17×10^{-1}
D) 4.2×10^{-1}
E) 4×10^{-1}

Question 2: **(1 pt)** The period of a pendulum is the time it takes the pendulum to swing back and forth once. If the only dimensional quantities that the period depends on are the acceleration of gravity, g, and the length of the pendulum, ℓ, what combination of g and ℓ must the period be proportional to? (Acceleration has SI units of $m.s^{-2}$).

A) g/ℓ
B) $g\ell^2$
C) $g\ell$
D) $\sqrt{g\ell}$
E) $\sqrt{\ell/g}$

Question 3: **(1 pt)** Under what condition is $|\vec{A} - \vec{B}| = A + B$?

A) The magnitude of vector $\vec{B}$ is zero.
B) Vectors $\vec{A}$ and $\vec{B}$ are in opposite directions.
C) Vectors $\vec{A}$ and $\vec{B}$ are in the same direction.
D) Vectors $\vec{A}$ and $\vec{B}$ are in perpendicular directions.
E) The statement is never true.

Question 4: **(1 pt)** The angle between vector $\vec{A} = 2.00\,\hat{\boldsymbol{i}} + 3.00\,\hat{\boldsymbol{j}}$ and vector $\vec{B}$ is 45.0°. The scalar product of vectors $\vec{A}$ and $\vec{B}$ is 3.00. If the x component of vector $\vec{B}$ is positive, what is vector $\vec{B}$.

A) $4.76\hat{\boldsymbol{i}} + 0.952\hat{\boldsymbol{j}}$
B) $3.42\hat{\boldsymbol{i}} + 0.684\hat{\boldsymbol{j}}$
C) $2.96\hat{\boldsymbol{i}} - 0.973\hat{\boldsymbol{j}}$
D) $0.871\hat{\boldsymbol{i}} + 0.419\hat{\boldsymbol{j}}$
E) $1.15\hat{\boldsymbol{i}} + 0.231\hat{\boldsymbol{j}}$

Question 5: (1 pt) A car accelerates from 10.0 m/s to 30.0 m/s at a rate of 3.00 m/s^2. How far does the car travel while accelerating?

A) 80.0 m
B) 133 m
C) 226 m
D) 399 m
E) 0 m

$v_i \quad v_f \quad a$

$v_f^2 = v_i^2 + 2a\Delta x$

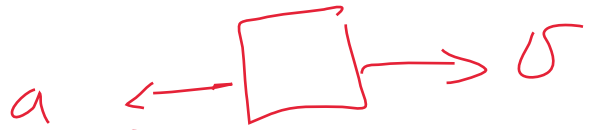
Question 6: (1 pt) A ball is thrown directly upward and experiences no air resistance. Which one of the following statements about its motion is correct?

A) The acceleration of the ball is upward while it is traveling up and downward while it is traveling down.
B) The acceleration of the ball is downward while it is traveling up and upward while it is traveling down.
C) The acceleration is downward during the entire time the ball is in the air.
D) The acceleration of the ball is downward while it is traveling up and downward while it is traveling down but is zero at the highest point when the ball stops.
E) None of the above

Question 7: (1 pt) A ball rolls across a floor with an acceleration of 0.100 m/s^2 in a direction opposite to its velocity. The ball has a velocity of 4.00 m/s after rolling a distance 6.00 m across the floor. What was the initial speed of the ball?

A) 4.15 m/s
B) 5.85 m/s
C) 4.60 m/s
D) 5.21 m/s
E) 3.85 m/s

$v_f \quad \Delta x$



a

$v_f^2 = v_i^2 + 2a\Delta x$

Question 8: (1 pt) The acceleration of an object as a function of time is given by $a(t) = (3.00\ \text{m/s}^3)t$, where t is in seconds. If the object is at rest at time $t = 0.00$ s, what is the velocity of the object at time $t = 6.00$ s?

A) 18.0 m/s
B) 54.0 m/s
C) 0.00 m/s
D) 15.0 m/s
E) 108 m/s

$v_i = 0$

$v_f = v_i + \int_0^6 a\,dt$

Question 9: (1 pt) If an object travels at a constant speed in a circular path, the acceleration of the object is

A) larger in magnitude the smaller the radius of the circle.
B) in the same direction as the velocity of the object.
C) smaller in magnitude the smaller the radius of the circle.
D) in the opposite direction of the velocity of the object.
E) zero.

$a_c = \frac{v^2}{R}$

Question 10: (1 pt) An object has a position given by $\vec{r}$ = [2.0 m + (3.00 m/s)t]$\hat{\imath}$ + [3.0 m - (2.00 m/s^2)t^2]$\hat{\jmath}$, where all quantities are in SI units. What is the magnitude of the acceleration of the object at time t = 2.00 s?

A) 1.00 m/s^2
B) 0.00 m/s^2
C) 0.522 m/s^2
D) 4.00 m/s^2
E) 2.00 m/s^2

$\vec{v} = \frac{d\vec{r}}{dt} = 3\hat{i} - 4t\hat{j}$

$\vec{a} = -4\hat{j}$

$|\vec{a}| = 4\ m/s^2$

Question 11: (1 pt) For general projectile motion, when the projectile is at the highest point of its trajectory

A) its acceleration is zero.
B) its velocity is perpendicular to the acceleration.
C) its velocity and acceleration are both zero.
D) the horizontal component of its velocity is zero.
E) the horizontal and vertical components of its velocity are zero.

Question 12: (1 pt) An electrical motor spins at a constant 2857.0 rev/min. If the armature radius is 2.685 cm, what is the acceleration of the outer edge of the armature?

A) 2403 m/s^2
B) 844.4 m/s^2
C) 241,100 m/s^2
D) 84.40 m/s^2
E) 0 m/s^2

R

$\frac{2857\ rev}{1\ rev}\ \frac{60\ s}{T}$

$T = \frac{60}{2857}$

$a = \frac{v^2}{R} = \frac{\left(\frac{2\pi R}{T}\right)^2}{R}$

$a = \frac{4\pi^2 R}{T^2}$

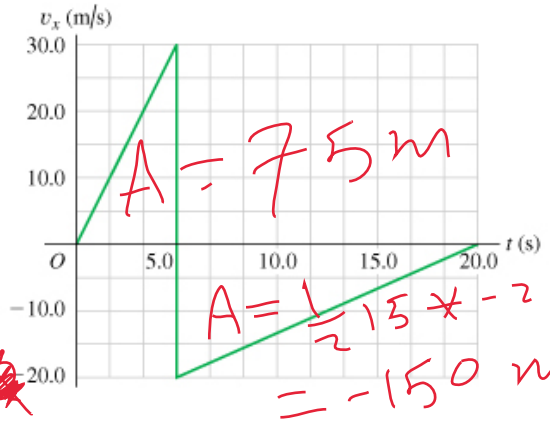
Part B: *Please solve the following problems showing all the steps of your solutions.*

Problem 1: (3 pts) You are to program a robotic arm on an assembly line to move in the *xy*-plane. Its first displacement is $\vec{A}$; its second displacement is $\vec{B}$ of magnitude 6.40 cm and direction 63.0° measured in the sense from the +*x*-axis toward the -*y*-axis. The resultant $\vec{C} = \vec{A} + \vec{B}$ of the two displacements should also have a magnitude of 6.40 cm, but a direction 22.0° measured in the sense from the +*x*-axis toward the +*y*-axis.

a) Draw the vector-addition diagram for these vectors, roughly to scale.
b) Find the components A_x and A_y of $\vec{A}$.
c) Find the magnitude and direction of $\vec{A}$.

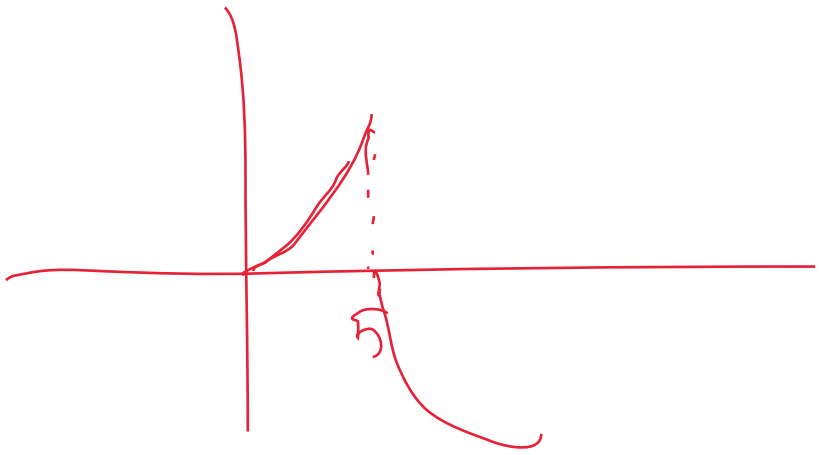
Problem 2: **(3 pts)** A rigid ball traveling in a straight line (the *x*-axis) hits a solid wall and suddenly rebounds during a brief instant. The graph in in the figure below shows this ball's velocity as a function of time. During the first 20.0 s of its motion, find:

a) The total distance the ball moves
b) Its displacement.
c) Sketch a graph of for this ball's motion (*x*-t graph).

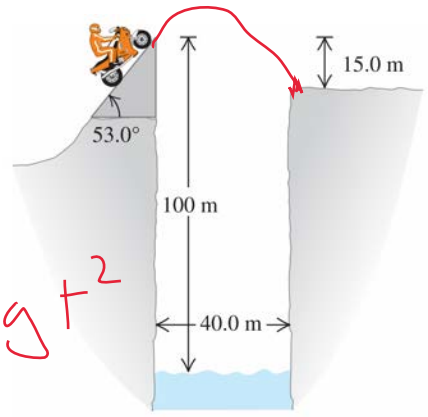


a) 75 + 150

b) 75 − 150



Problem 3: **(3 pts)** A person attempts to jump across a river on a motorcycle. The takeoff ramp was inclined at 53.0°, the river was 40.0 m wide, and the far bank was 15.0 m lower than the top of the ramp. The river itself was 100 m below the ramp. You can ignore air resistance.



a) What should his speed have been at the top of the ramp to have just made it to the edge of the far bank?
b) If his speed was only half the value found in part (a), where did he land?

$$\Delta x = 40 = v_{xi}\, t$$

$$y_f = y_i + v_{yi}\, t - \frac{1}{2} g t^2$$

$$-15 = v_i \sin 53 \left[\frac{40}{v_i \cos 53}\right] - 4.9\left(\frac{40}{v_i \cos 53}\right)^2$$

$$-15 = 40 \tan 53 - \frac{4.9 * 40^2}{\cos^2 53} * \frac{1}{v_i^2}$$

End of Exam

College of Arts and Sciences
Department of Mathematics, Statistics, and Physics
Physics Program

General Physics for Engineering I
PHYS 191
Spring 2016

23rd March 2016

Instructors: Dr. M. Al-Muraikhi, Dr. A. Shalaby, Dr. H. Merabet,
Dr. D. Al-Abdulmalik, Dr. L. Al-Sulaiti, Dr. M. Gharaibeh

EXAM 1

Student Name:

Student ID:

Section number:

20

Please read the following instructions carefully before you start answering

1. Make sure that you have 6 pages including two parts, A and B. Part A consists of 9 multiple choice questions, and part B consists of 3 problems.
2. Calculators are permitted but no electronic dictionaries or mobile phones.
3. All your work must be done on your exam paper; no loose papers are allowed.
4. This is a timed exam (120 min). Do not spend too much time on any particular question.

Useful Formulae and Constants

$\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, $\vec{v}_{av} = \frac{\Delta\vec{r}}{\Delta t}$, $\vec{v} = lim_{\Delta t \to 0}\frac{\Delta\vec{r}}{\Delta t} = \frac{d\vec{r}}{dt}$, $\vec{a}_{av} = \frac{\Delta\vec{v}}{\Delta t}$, $\vec{a} = lim_{\Delta t \to 0}\frac{\Delta\vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}$

$v_x = v_{0x} + a_x t$, $x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$, $v_x^2 = v_{0x}^2 + 2a_x(x - x_0)$, $x - x_0 = \left(\frac{v_{0x}+v_x}{2}\right)t$

$v_x = v_{0x} + \int_0^t a_x\, dt$, $x = x_0 + \int_0^t v_x\, dt$, $a_{rad} = \frac{v^2}{R}$

g = 9.80 m/s^2

Best Wishes

Part A. Please choose the correct answer for each question. ***Circle your choice using pen.***

8

Make sure that only ONE of the alternatives is chosen for each question. Two answers to one question will result in loss of the mark of that question.

1. What is the correct result of $2.43 \div 4.561$?

A. 5.3278×10^{-1}
B. 5.328×10^{-1}
C. 5.33×10^{-1}
D. 5.3×10^{-1}
E. 5×10^{-1}

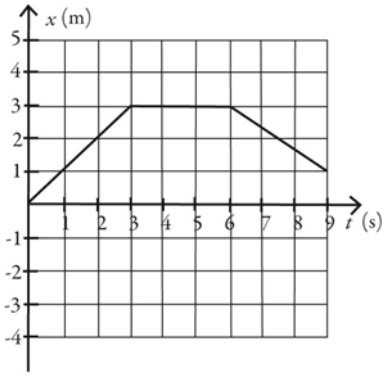
2. Determine the angle between the directions of vector $\vec{C} = 3.00\hat{\imath} + 1.00\hat{\jmath}$ and vector $\vec{D} = -3.00\hat{\imath} + 3.00\hat{\jmath}$.

A. 26.6^{o}
B. 30.0^{o}
C. 45.2^{o}
D. 88.1^{o}
E. 117^{o}

3. What is the vector product $\vec{B} \times \vec{C}$ of $\vec{B} = 3\hat{\imath} - 2\hat{\jmath}$ and $\vec{C} = 2\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$?
A. $4\hat{\imath} - 6\hat{\jmath} + 13\hat{k}$
B. $4\hat{\imath} + 6\hat{\jmath} - 13\hat{k}$
C. $4\hat{\imath} + 6\hat{\jmath} + 13\hat{k}$
D. $-4\hat{\imath} + 6\hat{\jmath} + 13\hat{k}$
E. $4\hat{\imath} - 6\hat{\jmath} - 13\hat{k}$

4. The figure below shows the position of an object as a function of time. During which time interval is the object at rest between 0.0 s and 9.0 s?

A. The object is at rest between 0.0 s and 3.0 s.
B. The object is at rest between 3.0 s and 6.0 s.
C. The object is at rest between 6.0 s and 9.0 s.
D. The object is never at rest.
E. The object is always at rest except at the instants t = 3.0 s and t = 6.0 s.



5. The position of a particle moving along the *x* axis is given by $x = 6.0t^2 - 1.0t^3$, where *x* is in meters and *t* in seconds. What is the position of the particle when it achieves its maximum speed in the positive *x* direction?

A. 2.0 m
B. 12 m
C. 16 m
D. 24 m
E. 32 m

6. The area under a curve in a velocity versus time graph gives

A. speed
B. velocity
C. acceleration
D. displacement
E. distance traveled

7. An Olympic athlete throws a javelin at four different angles above the horizontal, each with the same speed: 30^o, 40^o, 60^o, and 80^o. Which two throws cause the javelin to land the same distance away?

A. 30^o and 40^o
B. 30^o and 60^o
C. 30^o and 80^o
D. 40^o and 60^o
E. 40^o and 80^o

8. For a projectile launched horizontally, the vertical component of its velocity

A. continuously increases.
B. continuously decreases.
C. is zero.
D. remains a non-zero constant.

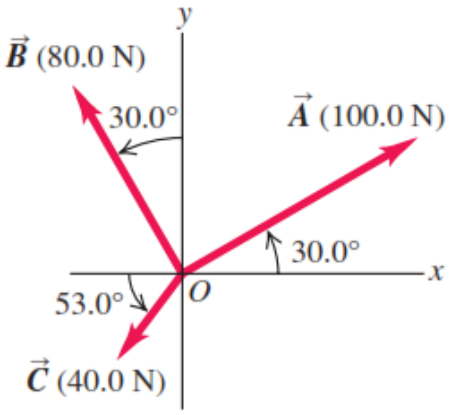
9. A car travels in a flat circle of radius *R*. At a certain instant the velocity of the car is 20 m/s north, and the total acceleration of the car is 2.5 m/s^2 37^o south of west. Which of the following is correct?

A. *R* = 0.16 km, and the car's speed is increasing.
B. *R* = 0.16 km, and the car's speed is decreasing.
C. *R* = 0.20 km, and the car's speed is increasing.
D. *R* = 0.20 km, and the car's speed is decreasing.
E. *R* = 0.40 km, and the car's speed is decreasing.

Part B. Please solve the following problems using *pen* and showing *all the steps of your solution in a clear tidy way*.

12

1. Three horizontal ropes pull on a large stone stuck in the ground, producing the force vectors $\vec{A}$, $\vec{B}$, and $\vec{C}$ shown in the figure below. Find the magnitude and direction of a fourth force on the stone that will make the vector sum of the four forces zero. (4 points)



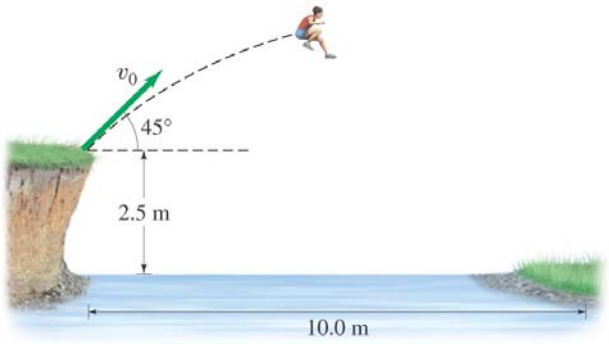
2. The velocity of an object which is initially at the origin and moving in the positive *x*-direction is given by

$$v(t) = 2.00\ m/s + (3.00\ m/s)t - (1.0\ m/s^2)\ t^2$$

A. Determine the acceleration of the object at t = 5.00 s. (2 points)
B. Determine the position of the object at t = 5.00 s. (2 points)

3. **A.** A long jumper leaves the ground at 45° above the horizontal and lands 8.0 m away. What is her "takeoff" speed v_0? (2 points)

B. Now the jumper is out on a hike and comes to the left bank of a river. There is no bridge and the right bank is 10.0 m away horizontally and 2.5 m vertically below (see the figure below). If she jumps from the edge of the left bank at 45° with the speed calculated in (A), how long, or short, of the opposite bank will she land? (2 points)



College of Arts and Sciences
Department of Mathematics, Statistics, and Physics
Physics Program

General Physics I (PHYS101) & General Physics for Engineering I (PHYS191)
Spring 2017

22nd March 2017

Instructors: Dr. L. Al-Sulaiti, Dr. M. Al-Muraikhi, Dr. A. Ayesh, Dr. M. Ajaib, Dr. M. Gharaibeh

EXAM 1

20

Student Name:

Student ID:

Section number: List Number:

Please read the following instructions carefully before you start answering

1. Make sure that you have 6 pages including two parts, A and B. Part A consists of 9 multiple choice questions, and part B consists of 3 problems.
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$v_x = v_{0x} + a_x t$, $x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$, $v_x^2 = v_{0x}^2 + 2a_x(x - x_0)$, $x - x_0 = \left(\frac{v_{0x}+v_x}{2}\right)t$

$v_x = v_{0x} + \int_0^t a_x\, dt$, $x = x_0 + \int_0^t v_x\, dt$, $a_{rad} = \frac{v^2}{R}$, $a_{total} = \sqrt{a_{rad}^2 + a_{tan}^2}$

g = 9.80 m/s^2

Best Wishes

Part A. Please choose the correct answer for each question. ***Circle your choice using pen*****.**

9

Make sure that only ONE of the alternatives is chosen for each question. Two answers to one question will result in loss of the mark of that question.

1- A person on a diet loses 2.2 kg in a week. How many micrograms/second (μg/s) are lost?

A) 3.6×10^3 μg/s
B) 4.1×10^3 μg/s
C) 4.3×10^3 μg/s
D) 4.6×10^3 μg/s
E) 2.6×10^3 μg/s

2- Let $\vec{A} = 2\hat{\imath} + 6\hat{\jmath} - 3\hat{k}$ and $\vec{B} = 4\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$. Then $\vec{A} \cdot \vec{B}$ equals:

A) $8\hat{\imath} + 12\hat{\jmath} - 6\hat{k}$
B) 14
C) 11
D) 8
E) 5

3- What is the vector product $\vec{A} \times \vec{B}$ of $\vec{A} = 2\hat{\imath} + 3\hat{\jmath} + 1\hat{k}$ and $\vec{B} = 1\hat{\imath} - 3\hat{\jmath} - 3\hat{k}$?

A) $-15 + 13\hat{\jmath} - 9\hat{k}$
B) $-3\hat{\imath} + 5\hat{\jmath} - 9\hat{k}$
C) $-6\hat{\imath} + 7\hat{\jmath} - 9\hat{k}$
D) $-9\hat{\imath} + 9\hat{\jmath} - 9\hat{k}$
E) $-12\hat{\imath} + 11\hat{\jmath} - 9\hat{k}$

4- A car accelerates from 10.0 m/s to 30.0 m/s at a rate of 4.00 m/s^2. How far does the car travel while accelerating?

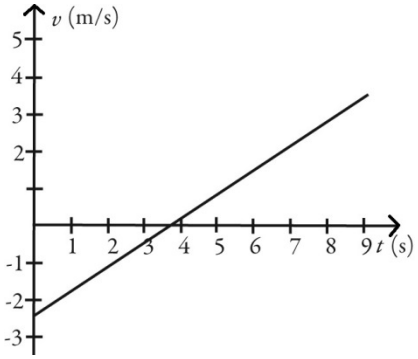
A) 66.7 m
B) 57.1 m
C) 133 m
D) 100. m
E) 80.0 m

5- As a rocket is accelerating vertically upward at 9.1 m/s^2 near the Earth's surface, it releases a projectile. Immediately after release the acceleration (in m/s^2) of the projectile is:

A) 9.8 up
B) 9.1 down
C) 9.1 up
D) 9.8 down
E) none of the above

6- The motion of a particle is described in the velocity versus time graph shown in the figure. We can say that its speed:

A) decreases and then increases.
B) increases.
C) decreases.
D) increases and then decreases.
E) none of the above.



7- A pilot drops a package from a plane flying horizontally at a constant speed. Neglecting air resistance, when the package hits the ground the horizontal location of the plane will

A) be behind the package.
B) be over the package.
C) be in front of the package.
D) depend of the speed of the plane when the package was released.
E) none of the above.

8- A satellite orbits the earth a distance of 21.35×10^6 m above the planet's surface and takes 4.65 hours for each revolution about the earth. The acceleration of this satellite is closest to

A) 1.11 m/s^2.
B) 0.870 m/s^2.
C) 3.01 m/s^2.
D) 2.04 m/s^2.
E) 1.47 m/s^2.

9- For a particle in uniform circular motion

A) Velocity is constant in magnitude and direction.
B) Acceleration is constant in magnitude and direction.
C) Velocity and acceleration are always parallel.
D) Acceleration has constant magnitude but varying direction.
E) Velocity and acceleration are perpendicular only at the top of the circle

Part B. Please solve the following problems using *pen* and showing *all the steps of your solution in a clear tidy way*.

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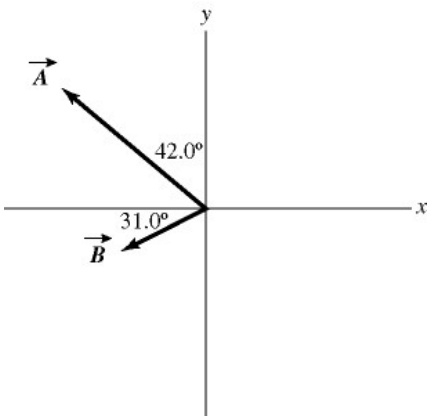
1. Vectors $\vec{A}$ and $\vec{B}$ are shown in the figure down. Vector $\vec{C}$ is given by $\vec{C} = \vec{B} - \vec{A}$. The magnitude of vector $\vec{A}$ is 18.0 units, and the magnitude of vector $\vec{B}$ is 9.00 units.:
   a. Write each vector in the figure shown in terms of the unit vectors. **(1.5-Point)**
   b. Use unit vectors to express the vector $\vec{C}$. **(1-Point)**
   c. Find the magnitude and direction of $\vec{C}$. **(0.5-Point)**
   d. Find the angle of the vector $\vec{C}$ with +*x*-axis measured counterclockwise. **(1-Point)**



2. The position of an object as a function of time is given by $x(t) = at^3 - bt^2 + ct - d$, where $a = 3.6\ \text{m/s}^3$, $b = 4.0\ \text{m/s}^2$, $c = 60\ \text{m/s}$ and $d = 7.0\ \text{m}$. **Put you final answer with right significant figures.**

    a. Find the instantaneous acceleration at t =3.5 s. **(2-Point)**

    b. Find the average acceleration over the first 3.5 seconds (from t_1= 0 s to t_2 = 3.5 s). **(2-Point)**

3. In Fig. below, a stone is projected at a cliff of height h with an initial speed of 45.0 m/s directed at angle θ_o = 60.0° above the horizontal. The stone strikes at A, 6.50 s after launching. Find:

   a. the height h of the cliff. **(1 Points)**
   b. the speed of the stone just before impact at A **(1.75 Points)**
   c. the maximum height H reached above the ground . **(1.25 Points)**