

Instructor(s): *Korytov/Matcheva*PHYSICS DEPARTMENT  
Exam 1

September 23, 2013

Name (print, last first): \_\_\_\_\_

Signature: \_\_\_\_\_

*On my honor, I have neither given nor received unauthorized aid on this examination.***YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.**

- (1) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number).** Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY.** Code your UFID number on your answer sheet.
- (2) Print your name on this sheet and sign it also.
- (3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
- (4) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink.** Do not make any stray marks or some answers may be counted as incorrect.
- (5) **The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no listed answer is correct, leave the form blank.**
- (6) Hand in the answer sheet separately.

$g = 9.8 \text{ m/s}^2$

Air resistance is to be neglected.

1. During a short interval of time the speed  $v$  in m/s of an automobile is given by  $v = at^2 + bt^3$ , where the time  $t$  is in seconds and  $a$  and  $b$  are constants. The units of  $a$  and  $b$  are respectively:

- (1)  $\text{m/s}^3; \text{m/s}^4$       (2)  $\text{s}^3/\text{m}; \text{s}^4/\text{m}$       (3)  $\text{m/s}^2; \text{m/s}^3$       (4)  $\text{m}\cdot\text{s}^2; \text{m}\cdot\text{s}^4$       (5)  $\text{m/s}^4; \text{m/s}^5$

2. Starting at time  $t = 0$ , an object moves along a straight line with velocity in m/s given by  $v(t) = 98 - 2t^2$ , where  $t$  is in seconds. When it momentarily stops, its acceleration is:

- (1)  $-28 \text{ m/s}^2$       (2)  $-4.0 \text{ m/s}^2$       (3)  $-9.8 \text{ m/s}^2$       (4) 0      (5)  $49 \text{ m/s}^2$

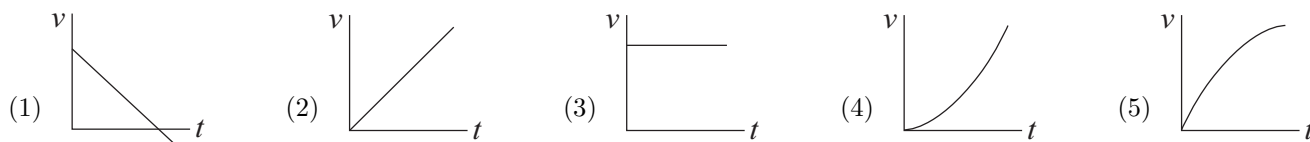
3. At a stop light, a truck traveling at 15 m/s passes a car as it starts from rest. The truck travels at constant velocity and the car accelerates at a constant rate of  $3 \text{ m/s}^2$ . How much time does the car take to catch up to the truck?

- (1) 10 s      (2) 5 s      (3) 15 s      (4) 20 s      (5) 25 s

4. A baseball is hit straight up and is caught by the catcher 2.0 s later at the same level as it was hit. The initial velocity of the ball is:

- (1) 9.8 m/s      (2) 7.4 m/s      (3) 19.4 m/s      (4) 38.8 m/s      (5) 19.6 m/s

5. An object is thrown up vertically into the air. Which of the following five graphs represents the velocity ( $v$ ) of the object as a function of the time ( $t$ )? The positive direction is taken to be upward.



6. The result of the expression  $\hat{i} \cdot (\hat{k} \times \hat{j})$  is:

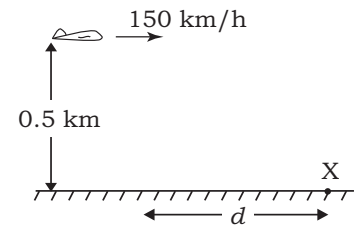
- (1)  $-1$       (2) 1      (3) 0      (4)  $\hat{i}$       (5)  $-\hat{i}$

7. The angle between vectors  $(0,3,4)$  and  $(2,-1,0)$  is:

- (1)  $106^\circ$                       (2)  $74^\circ$                       (3)  $80^\circ$                       (4)  $97^\circ$                       (5)  $172^\circ$

8. The airplane shown in the picture is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what distance  $d$  should it release a heavy bomb to hit the target X?

- (1) 421 m  
(2) 295 m  
(3) 150 m  
(4) 2550 m  
(5) 15,000 m

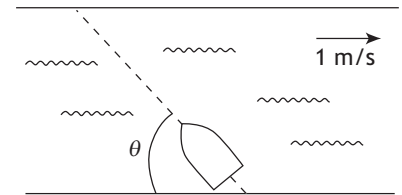


9. Two objects are traveling around different circular orbits with constant speed. They both have the same acceleration, but object A is traveling with a linear speed twice as fast as object B. The orbit radius for object A is \_\_\_\_\_ the orbit radius for object B.

- (1) four times                      (2) one-half                      (3) the same as                      (4) twice                      (5) one-fourth

10. A boy wishes to row across a river in the shortest possible time. He can row at 2 m/s in still water, and the river is flowing at 1 m/s. At what angle  $\theta$  should he point the bow (front) of his boat? See figure.

- (1)  $90^\circ$   
(2)  $30^\circ$   
(3)  $45^\circ$   
(4)  $60^\circ$   
(5)  $63^\circ$



11. A ball with a weight of 1.5 N is thrown at an angle of  $30^\circ$  above the horizontal with an initial speed of 12 m/s. At its highest point, the net force on the ball is:

- (1) 1.5 N, down                      (2) zero                      (3) 9.8 N, up                      (4) 9.8 N, down                      (5) 9.8 N,  $30^\circ$  below horizontal

12. A heavy steel ball B is suspended by a cord from a block of wood W (see figure). The entire system is dropped through the air. Neglecting air resistance, the tension in the cord is:

- (1) zero  
(2) the difference in the masses of B and W  
(3) the difference in the weights of B and W  
(4) the weight of B  
(5) none of these

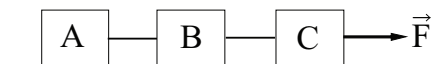


13. A 5-kg block is suspended by a rope from the ceiling of an elevator that accelerates downward at  $3.0 \text{ m/s}^2$ . The tension force of the rope on the block is:

- (1) 34 N, up                      (2) 34 N, down                      (3) 15 N, up                      (4) 64 N, up                      (5) 64 N, down

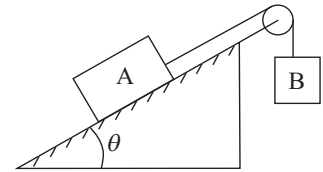
14. Three blocks (A,B,C), each having mass  $M$ , are connected by strings as shown in the picture. Block C is pulled to the right by a force that causes the entire system to accelerate. Neglecting friction, the net force acting on block B is:

- (1)  $F/3$                       (2) zero                      (3)  $F/2$                       (4)  $2F/3$                       (5)  $F$

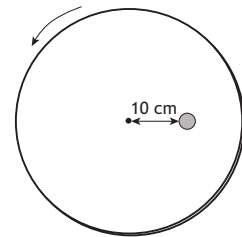


15. A sled is on an icy (frictionless) slope that makes an angle of  $30^\circ$  with the horizontal. When a 40 N force, parallel to the incline and directed up the incline, is applied to the sled, the acceleration of the sled is  $2.0 \text{ m/s}^2$ , down the incline. The mass of the sled is:
- (1) 13.7 kg                      (2) 4.1 kg                      (3) 5.8 kg                      (4) 6.2 kg                      (5) 3.8 kg
16. A brick slides on an inclined surface. Which of the following will decrease the frictional force on it?
- (1) Increase the angle of inclination.  
 (2) Decrease the surface area of contact.  
 (3) Increase the surface area of contact.  
 (4) Increase the mass of the brick.  
 (5) None of the others
17. A desk rests on a rough horizontal surface ( $\mu_s = 0.50$ ,  $\mu_k = 0.40$ ). A constant horizontal force, just sufficient to start the desk in motion, is applied. The acceleration of the desk is:
- (1)  $0.98 \text{ m/s}^2$                       (2)  $0 \text{ m/s}^2$                       (3)  $3.3 \text{ m/s}^2$                       (4)  $4.5 \text{ m/s}^2$                       (5)  $8.9 \text{ m/s}^2$

18. Block A, with a mass of 10 kg, rests on a  $\theta = 35^\circ$  incline. The coefficient of static friction is 0.40. An attached massless string is parallel to the incline and passes over a massless, frictionless pulley at the top. The largest mass  $m_B$  of block B, attached to the dangling end, for which A begins to slide down the incline is:



- (1) 2.5 kg                      (2) 3.5 kg                      (3) 5.9 kg                      (4) 9.0 kg                      (5) 10.5 kg
19. A small coin rests on a table. The table turns around its center at a constant rate. The distance between the coin and the center of the table is 10 cm. The coefficient of static friction between the coin and the table is 0.5. What is the maximum angular velocity of the table for which the coin does not slide?



- (1) 7 rad/s  
 (2) 14 rad/s  
 (3) 49 rad/s  
 (4) 0.7 rad/s  
 (5) 1.4 rad/s
20. One end of a 1.0-m string is fixed, the other end is attached to a 2.0-kg stone. The stone swings in a vertical circle, passing the top point at  $4.0 \text{ m/s}$ . The tension force of the string at this point is about:
- (1) 12.4 N                      (2) 0 N                      (3) 20.5 N                      (4) 32.1 N                      (5) 52.8 N