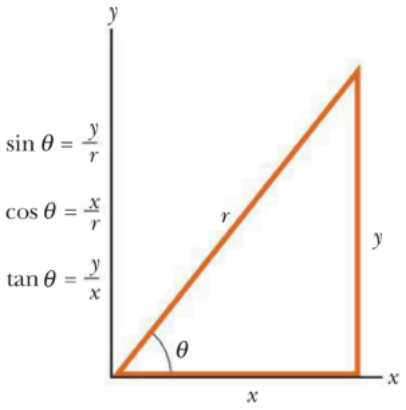
MIDTERM 1 SOLUTIONS, Feb. 11, 2019

SOLUTIONS ARE IN BOLD. Print your name clearly above, and write and bubble in your student 800 number on the provided scantron. There are 20 equally-weighted problems on this test, and there is only one correct answer per question. **Clearly circle your answer, AND also fill out the corresponding bubble on your scantron sheet.** The key will be posted online after all make-up tests are completed. Your test grade will appear on ecampus or WebAssign. If I decide to curve the test, your test grade online will be curved. Good luck!

POTENTIALLY USEFUL INFORMATION (**SOME EQUATIONS ARE ONLY VALID IN SPECIFIC SITUATIONS**):

Conversions: 1 m = 3.281 ft 1 mile = 1609 m 1 kg = 2.2 pounds g = 9.8 m/s^2 = 32 ft/s^2

1 pound = 4.45 N 1 hp = 746 W



$\sin\theta = \frac{y}{r}$

$\cos\theta = \frac{x}{r}$

$\tan\theta = \frac{y}{x}$

$r^2 = x^2 + y^2$

1D or 2D motion:

$$\bar{v} = \frac{\Delta x}{\Delta t} \qquad \bar{a} = \frac{\Delta v}{\Delta t} \qquad v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} \qquad a = \lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t}$$

$$x = x_o + \bar{v}t = x_o + v_o t + \frac{1}{2}at^2 \qquad v = v_o + at$$

$$v^2 = v_o{}^2 + 2a(x - x_o)$$

Quadratic formula:

$$ax^2 + bx + c = 0 \rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\vec{F} = \sum_i \vec{F}_i = m\vec{a} = \frac{\Delta \vec{p}}{\Delta t} \qquad F_g = mg \qquad F_s \le \mu_s n \qquad F_k = \mu_k n \qquad \vec{F}_{AB} = -\vec{F}_{BA}$$

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1. The observation deck of the Empire State Building is 1224 ft above street level. Ignoring air resistance, if someone dropped a penny from the top, how long would the penny take to reach the street?

a.) 77 s **b.) 8.7 s** c.) 38 s d.) 9.8 s e.) 6.2 s

2. Assuming all the same values in the preceding question about the Empire State Building, how fast would a penny that is dropped from the observation deck be traveling when it reached the street?

a.) 280 ft/s b.) 85 ft/s c.) 1200 ft/s d.) 32 ft/s e.) 200 ft/s

3. 10 m/s is equal to which of the following

a.) 10 N b.) 22 lbs c.) 10 ft/s d.) 33 ft/s^2 **e.) 22 miles/hr**

4. If you throw a ball straight upward with velocity v on the surface of the Moon, the ball will rise for 6 times as many seconds as it would on Earth if thrown with the same velocity. Which of the following gives the ratio of the lunar acceleration to the acceleration on Earth, g_{Moon}/g_{Earth}?

a.) 1/36 **b.) 1/6** c.) $\sqrt{1/6}$ d.) 6 e.) 36

5. In the preceding question, what would be the ratio of the height that the ball would reach on the Moon to the height that it would reach on Earth, y_{Moon}/y_{Earth}?

a.) 1/36 b.) 1/6 c.) $\sqrt{1/6}$ **d.) 6** e.) 36

6. If you throw a ball horizontally how long will it take to hit the ground, compared to if you dropped the ball from the same height?

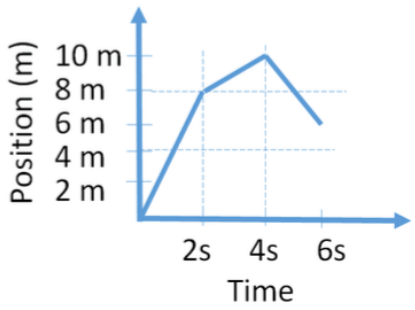
a.) The thrown ball will take longer to hit. b.) The thrown ball will take less time to hit.

c.) Both balls will take the same amount of time. d.) It depends on which is more massive.

7. Assuming that about 200 million people in the U.S. participate in Halloween, **estimate** how much money Americans spend annually on Halloween candy.

a.) $2 million b.) $20 million **c.) $2 billion** d.) $200 billion e.) $2 trillion

8. The position of a car is shown in the graph on the following graph. Which answer is closest to the **instantaneous** velocity of the car at a time of 1 second?



a.) 1.0 m/s

b.) 2.0 m/s

c.) 2.5 m/s

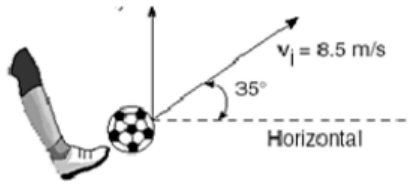
d.) 3.0 m/s

e.) 4.0 m/s

9. On the same graph in question 8 above, find the average velocity over the time period from 2 to 6 seconds.

a.) -0.5 m/s b.) -1.0 m/s c.) -2.0 m/s d.) 0.5 m/s e.) 1.0 m/s

Questions 10-12 relate to the following picture, showing a child kicking a ball with an initial velocity of 8.5 meters per second at an angle of 35° with the horizontal.



10. The ball reaches its peak height in how many seconds?

a.) 0.5 s b.) 5 s c.) 4.9 s d.)10 s e.) 1.8 s

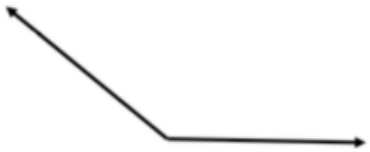
11. The peak height is

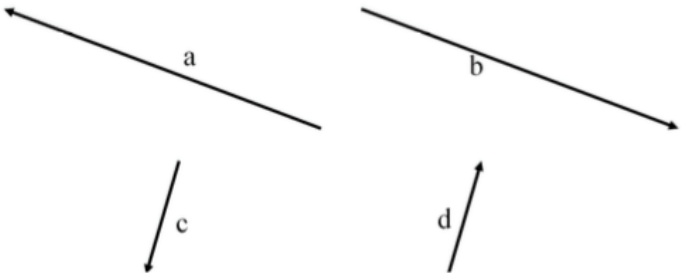
a.) 9.8 m b.) 4.9 m **c.) 1.2 m** d.) 3.0 m e.) 6.2 m

12. The total distance traveled horizontally is

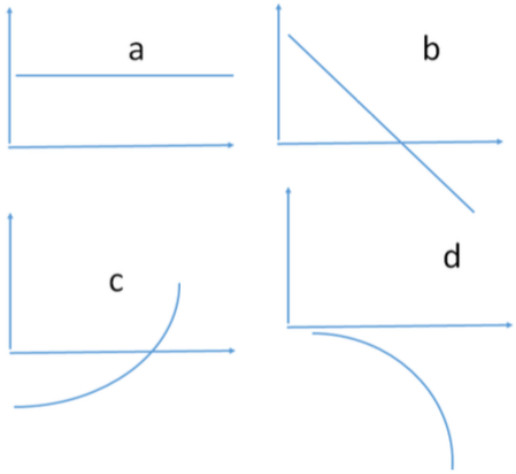
a.) 4.3 m **b.) 7.0 m** c.) 8.5 m d.) 12 m e.) 3.5 m

13. Add the two vectors on the right using any method you prefer. The correct answer is closest to: **d**





Questions 14-16 refer to the following graphs:



14. If the graphs show position vs. time, which of them illustrate zero acceleration?

a.) a only b.) b only c.) c only d.) d only **e.) a and b**

15. If the graphs show velocity vs. time, which of them show constant acceleration?

a.) a only b.) b only c.) c only d.) d only **e.) a and b**

16. If the graphs show acceleration vs. upward velocity, which would be consistent with acceleration due only to gravity?

a.) a only b.) b only c.) c only d.) d only e.) a and b

17. For an object in free fall, the sign of acceleration due to gravity depends on

a.) Which direction the object is moving **b.) Which direction I call positive**

c.) both a and b d.) Neither a nor b

18. If I throw a ball straight up into the air with a positive velocity of 20.0 m/s, the acceleration due to gravity when the ball reaches its highest point will be

a.) 0 m/s^2 b.) 9.81 m/s^2 c.) 20.0 m/s^2 **d.) -9.81 m/s^2** e.) -20.0 m/s^2

19. If the gravitational pull of the Earth on your textbook is the action, then the reaction from Newton's third law is

a.) the normal force from the table supporting the book.

b.) the pull of your book on the Earth.

c.) the electromagnetic interaction of the atoms in your book.

d.) the atomic interactions within the table

20. If I push on an 8.0 kg object that is initially at rest with 35.0 N of force, and if the coefficient of kinetic friction is 0.40 and the coefficient of static friction is 0.50, what will the acceleration of the object be?

a.) 0 m/s^2 b.) 0.45 m/s^2 c.) 0.53 m/s^2 d.) 3.9 m/s^2 e.) 4.9 m/s^2