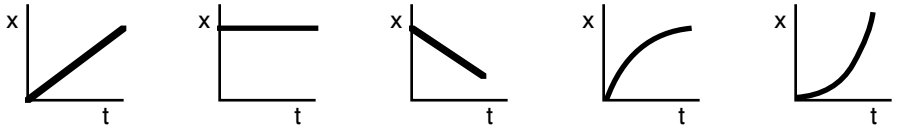
# Mid Year Review

**Directions:** Choose the letter of the best answer for each of the questions. Good Luck!

## Linear Motion I

*The following diagram is for problems 1 to 3.*



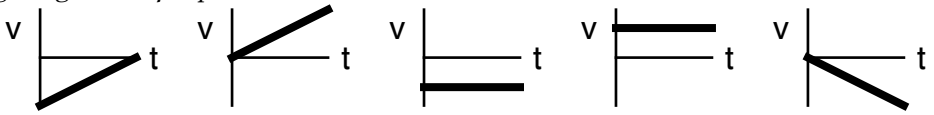

a. b. c. d. e.

1. _____ Which of the graphs shows an object that is standing still?

2. _____ Which of the graphs shows an object that is moving forwards and slowing down?

3. _____ Which of the graphs shows an object that is moving backwards with a constant speed?

*The following diagram is for problems 4 to 6.*




a. b. c. d. e.

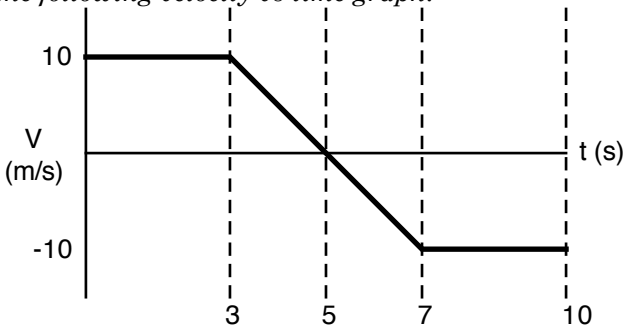
4. _____ Which of the graphs shows an object that is going backwards with a constant speed?

5. _____ Which of the graphs shows an object that is moving forwards and speeding up?

6. _____ Which of the graphs shows an object that is moving backwards with a positive acceleration?

7. _____ The average speed of a horse that gallops a distance of 10 kilometers in a time of 30 minutes is
a. 10 km/h. b. 20 km/h. c. 30 km/h. d. > 30 km/h.

*Problems 8 to 10 refer to the following velocity vs time graph:*




8. _____ From 3 to 5 seconds, what was the acceleration?
a. 10 $m/s^2$. b. –10 $m/s^2$. c. –5 $m/s^2$. d. –2 $m/s^2$. e. 0 $m/s^2$.

9. _____ From 5 to 7 seconds, what was the acceleration?
a. 10 $m/s^2$. b. –10 $m/s^2$. c. –5 $m/s^2$. d. –2 $m/s^2$. e. 0 $m/s^2$.

10. _____ At exactly t = 5 seconds, what was the acceleration?
a. 10 $m/s^2$. b. –10 $m/s^2$. c. –5 $m/s^2$. d. –2 $m/s^2$. e. 0 $m/s^2$.

# Mid Year Review

## Linear Motion II

11. _____ If you drop something on the earth, it speeds up as it falls. How much faster is it going for each second that it falls?
a. 0 m/s. b. 5 m/s. c. 10 m/s. d. 20 m/s.

12. _____ A ball is thrown straight up in the air with an initial speed of 25 m/s. How many seconds does it take to reach its maximum height?
a. 10 s. b. 250 s. c. 5 s. d. 2.5 s.

13. _____ A car has a speed of 25 m/s when it hits the brake and slows down at a rate of 2 $m/s^2$. How fast is it going after 4 seconds?
a. 8 m/s. b. 17 m/s. c. 21 m/s. d. 33 m/s.

14. _____ 4 seconds after being dropped from rest, a rock would have a speed of about
a. 2.5 m/s. b. 4 m/s. c. 10 m/s. d. 40 m/s.

15. _____ A heavy object and a light object are dropped from the same height at the same time on the moon. The heavier object reaches the ground
a. before the lighter object. b. at the same time as the lighter object.
c. after the lighter object.

16. _____ A ball is tossed straight up in the air and is caught at the same height from which it was thrown. It was in the air a total of 3 seconds. What was the initial speed of the ball?
a. 1.5 m/s. b. 3 m/s. c. 15 m/s. d. 30 m/s.

17. _____ A car accelerates from rest at 2 m/s/s. What is its speed 3 seconds after the car starts moving?
a. 2 m/s. b. 3 m/s. c. 4 m/s. d. 6 m/s.

18. _____ When you toss an orange up in the air, it slows down while it is going up and it speeds up while it is going down. What is true about the acceleration of the orange while it is in the air?
a. The acceleration is constant; it is always 10 $m/s^2$ and directed down.
b. The orange has two different accelerations, positive while it goes up and negative while it goes down.
c. The orange has two different accelerations, negative while it goes up and positive while it goes down.
d. The acceleration constantly changes at 10 $m/s^2$, so it depends on how long it was in the air.

19. _____ If you are accelerating in the opposite direction of your velocity, what must be happening?
a. You must be speeding up. b. You must be slowing down.
c. You must be going in a circle at constant speed.
d. Huh? It is impossible to accelerate in the opposite direction of your velocity.

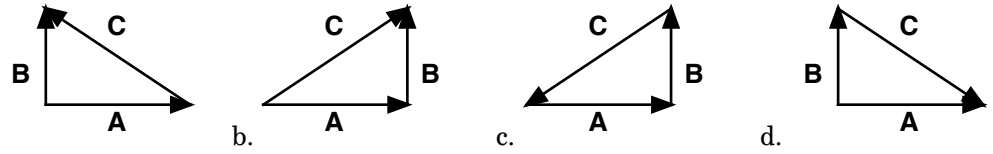
## Vectors

20. _____ Two velocity vectors will have the maximum resultant velocity when they
a. act in opposite directions
b. act in the same direction
c. act at a 45° angle to one another

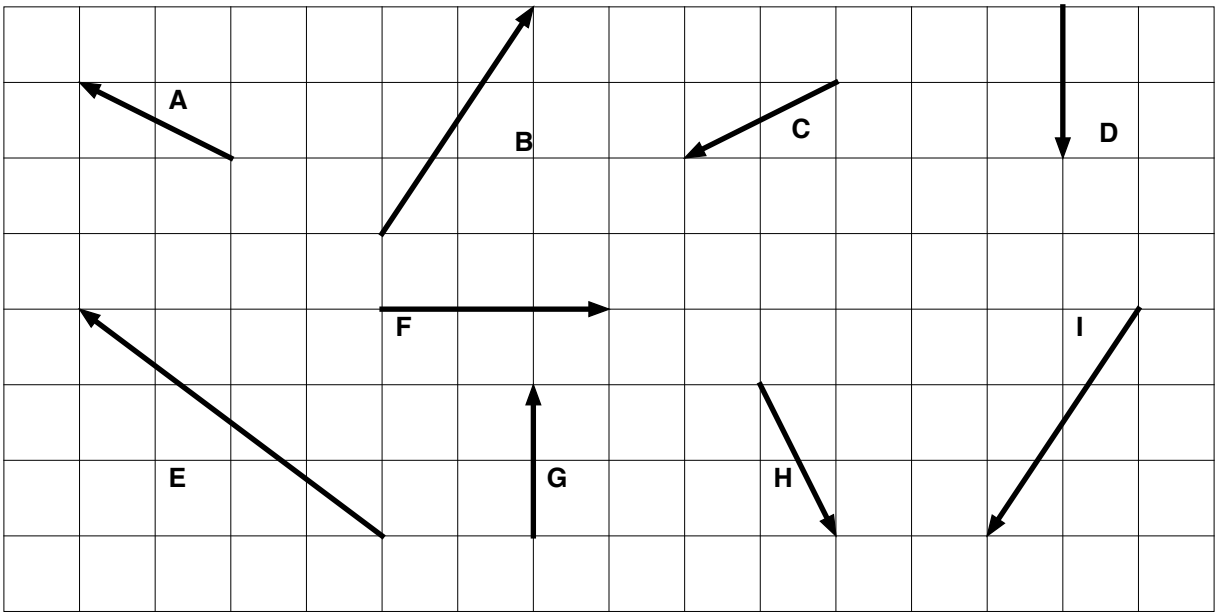
21. _____ If a plane has an air speed of 100 m/s due North, and there is a strong cross wind of 50 m/s due East, what is the resultant speed of the plane with respect to the ground?
a. 50 m/s. b. 100 m/s. c. 112 m/s. d. 150 m/s.

# Mid Year Review

22. _____ Which of the following diagrams correctly shows how you would add two vectors (**A** & **B**) to find the resultant vector (**C**)?




*Problems 23 to 27 refer to the following vectors:*




23. _____ Which pair(s) of vectors could cancel each other out?

24. _____ Which vector(s) has a vertical component of –1?

25. _____ Which vector(s) has a horizontal component of +3?

26. _____ Which vector(s) has a magnitude of 5?

27. _____ What would be the components of vector sum of **A** + **B**?
a. x = 0 & y = 4. b. x = 4 & y = 4. c. x = 4 & y = 2. d. x = 0 & y = 2.

*Problems 28 to 32 refer to the following:*
A wildebeest moves in a straight line, covering 50 meters at an angle of 30° North of East in a time of 40 s.

28. _____ How far <u>east</u> did the wildebeest travel? (What is the x-component of its displacement?)
a. 50 m. b. 0 m. c. 7.7 m. d. 25 m. e. 43.3 m.

29. _____ How far <u>north</u> did the wildebeest travel? (What is the y-component of its displacement?)
a. 50 m. b. 0 m. c. 7.7 m. d. 25 m. e. 43.3 m.

30. _____ What is the x-component of it velocity?
a. 1.25 m/s. b. 1.08 m/s. c. 0.63 m/s. d. 0.5 m/s. e. 0.87 m/s.

31. _____ What is the y-component of it velocity?
a. 1.25 m/s. b. 1.08 m/s. c. 0.63 m/s. d. 0.5 m/s. e. 0.87 m/s.

32. _____ How fast was the wildebeest moving?
a. 1.25 m/s. b. 1.08 m/s. c. 0.63 m/s. d. 0.5 m/s. e. 0.87 m/s.

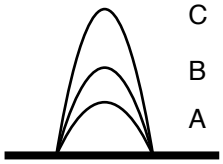
# Mid Year Review

## Projectile Motion

33. _____ A projectile has an initial velocity of 25 m/s at an angle of 30° above the horizontal. What are the components of the initial velocity?
a. $v_x$ = 0.866 m/s & $v_y$ = 0.5 m/s. b. $v_x$ = 21.7 m/s & $v_y$ = 12.5 m/s.
c. $v_x$ = 0.5 m/s & $v_y$ = 0.866 m/s. d. $v_x$ = 12.5 m/s & $v_y$ = 21.7 m/s.

34. _____ A cannon fires a cannon ball at an angle of 20° degrees above horizontal. Which of the following statement is <u>not</u> true about the cannon ball while it flies in the air?
a. The horizontal velocity remains constant.
b. The vertical velocity changes by 10 m/s every second.
c. The velocity of the ball at the highest point is zero.
d. The range of the ball is equal to the horizontal velocity times the time in air.

35. _____ Three projectiles are launched across a level field from the same place. Their paths through the air are shown in the diagram. (All the projectiles land in the same place.) Which projectile was in the air the longest?
a. A b. B c. C
d. they were all in the air the same amount of time.




36. _____ Which initial angle would get the maximum range for a projectile fired across level ground?
a. 30°. b. 45°. c. 60°. d. 90°

37. _____ Which initial angle would give the projectile the maximum amount of time in the air?
a. 30°. b. 45°. c. 60°. d. 90°

*Problems 38 to 42 refer to the following:*
A projectile is launched across a level field. Its initial velocity has the components $v_x$ = 5 m/s and $v_{yi}$ = 12 m/s.

38. _____ What was the initial speed of the projectile?
a. 0 m/s. b. 5 m/s. c. 12 m/s. d. 13 m/s. e. 17 m/s.

39. _____ How long will the projectile be in the air?
a. 0.5 s. b. 1.0 s. c. 2.4 s. d. 1.2 s. e. 10 s.

40. _____ How fast is the projectile going at its maximum height?
a. 0 m/s. b. 5 m/s. c. 12 m/s. d. 13 m/s. e. 17 m/s.

41. _____ What is the maximum height of the projectile?
a. 7.2 m. b. 14.4 m. c. 6.0 m. d. 3.0 m. e. 3.6 m.

42. _____ Where does the projectile land? (How far sideways does it travel?)
a. 31.2 m. b. 14.4 m. c. 6.0 m. d. 28.8 m. e. 12 m.

43. _____ While a projectile is in the air, which of the following statements are true?
I. The projectile has a constant horizontal velocity.
II. The projectile has a constant acceleration vertically.
III. At its maximum height, the speed of a projectile is zero.
a. I only. b. II only. c. I & II only. d. I & III only. e. I, II & III.

*Problems 44 to 49 refer to the following:*
A ball rolls horizontally off a table with a speed of 4 m/s. It is in the air for 0.6 seconds.

44. _____ How far (horizontally) away from the edge of the table does the ball land?
a. 1.8 m. b. 1.2 m. c. 2.4 m. d. 4.8 m. e. 6.0 m.

45. _____ How high was the table?
a. 1.8 m. b. 1.2 m. c. 2.4 m. d. 4.8 m. e. 6.0 m.

# Mid Year Review

46. _____ What is the initial velocity of the ball, just as it rolls off the table?
a. $v_x = 4$ m/s & $v_y = 0$ m/s. b. $v_x = 0$ m/s & $v_y = 0$ m/s.
c. $v_x = 4$ m/s & $v_y = -10$ m/s. d. $v_x = 4$ m/s & $v_y = -6$ m/s.

47. _____ What is the final velocity of the ball, just as it hits the ground?
a. $v_x = 4$ m/s & $v_y = -10$ m/s. b. $v_x = 10$ m/s & $v_y = -6$ m/s.
c. $v_x = 4$ m/s & $v_y = -6$ m/s. d. $v_x = 0$ m/s & $v_y = -6$ m/s.

48. _____ If the ball rolled off the same table, but with a speed of 8 m/s, how long would it be in the air?
a. 0.8 s. b. 0.6 s. c. 1.2 s. d. 1.6 s. e. 10 s.

49. _____ If the ball rolled off the same table, but with a speed of 8 m/s, how far away would it land?
a. 1.8 m. b. 1.2 m. c. 2.4 m. d. 4.8 m. e. 6.0 m.

50. _____ Imagine you kick a ball across a level field with a certain initial velocity and it lands somewhere. If you wanted to kick it again, and make sure that it landed farther away, which of the following should you change?
I. Make the initial horizontal velocity bigger.
II. Make the initial vertical velocity bigger.
III. Make the initial angle bigger.
a. I only. b. II only. c. I & II only. d. II & III only. e. I, II & III.

51. _____ Imagine you kick a ball across a level field with a certain initial velocity and it lands somewhere. If you wanted to kick it again, and make sure that it was in the air for a longer time, which of the following could you change?
I. Make the initial horizontal velocity bigger.
II. Make the initial vertical velocity bigger.
III. Make the initial angle bigger.
a. I only. b. II only. c. I & II only. d. II & III only. e. I, II & III.

## Newton's 1st Law

52. _____ The mass of a dog that weighs 100 N is about
a. 1 kg. b. 10 kg. c. 100 kg. d. 1000 kg.

53. _____ Which of the following statements is true?
a. Your mass is the same everywhere in the universe, but your weight changes.
b. Your weight is the same everywhere in the universe, but your mass changes.
c. Both your mass and your weight are the same everywhere in the universe.
d. Both your mass and your weight change, depending on where you are.

54. _____ On the surface of the earth, a person with a mass of 75 kg weighs about
a. 7.5 N b. 165 N c. 75 N d. 750 N

55. _____ A 10 kg brick and a 1 kg brick are both dropped in a vacuum. The force of gravity on the 10 kg brick is
a. the same as the force on the 1 kg brick.
b. 10 times as much force on the 1 kg brick.
c. zero.

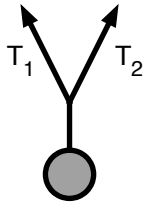
56. _____ The force required to maintain an object at a constant speed in outer space is
a. zero b. equal to the mass of the object
c. equal to the weight of the object d. equal to the force required to stop it
e. none of the above

# Mid Year Review

57. _____ This test paper is at rest on your desk. Which one of the following statements best describes this situation?
   a. There are no forces acting on your paper.
   b. The desk exerts no force on your paper.
   c The paper exerts no force on your desk.
   d. The resultant of the forces acting on your paper is zero.

58. _____ Which of the following have inertia?
   a. a moving car. b. a standing woman.
   c. a flying mosquito. d. all of these.
   e. none of these.

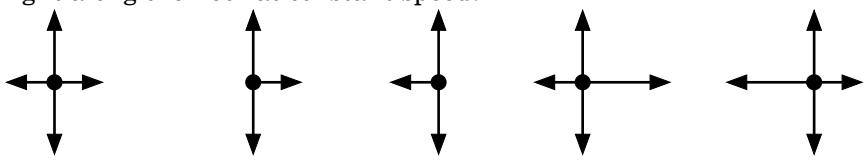
59. _____ A mass is at rest hanging from two strings as shown in the diagram. The tensions in the two strings are labeled. Which of the following statements must be true?




   a. The horizontal components of the tensions must cancel, and the vertical components must add up to the mass.
   b. The vertical components of the tensions must cancel, and the horizontal components must add up to the mass.
   c. The horizontal components of the tensions must cancel, and the vertical components must add up to the weight of the mass.
   d. The vertical components of the tensions must cancel, and the horizontal components must add up to the weight of the mass.

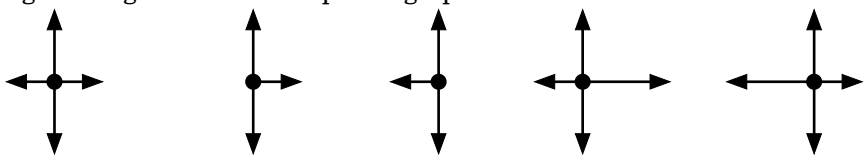
## Newton's 2nd Law

60. _____ Which of the following would be the best free body diagram for a box being pulled to the right along the floor at constant speed?



a. b. c. d. e.

61. _____ Which of the following would be the best free body diagram for a box being pulled to the right along the floor and speeding up?



a. b. c. d. e.

62. _____ Suppose the force of friction on a sliding object is 10 N. The force needed to maintain a constant velocity is
   a. more than 10 N. b. less than 10 N. c. 10 N.

63. _____ A mass of 1 kg is accelerating at a rate of 1 $m/s^2$. It is experiencing a net force of
   a. 1 N. b. 10 N. c. 0 N. d. none of the above

64. _____ Equal forces act on two bodies, A and B. If the mass of B is 3 times greater than the mass of A, the acceleration of A will be:
   a. 3 times that of B b. 9 times that of B
   c. the same d. 1/3 that of B
   e. 1/9 that of B

# Mid Year Review

65. _____ A 10 N force and a 30 N force act on an object in opposite directions. What is the net force on the object?
a. 40 N b. 30 N c. 20 N d. 10 N e. none of the above

66. _____ A 10 N falling object encounters 10 N of air resistance. The magnitude of the net force on the object is
a. 0 N b. 0.1 N c. 1 N d. 9.8 N e. none of the above

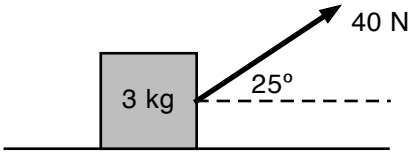
67. _____ A car has a mass of 1000 kg and accelerates at 2 m/s/s. What is the magnitude of the net force acting on the car?
a. 500 N b. 1000 N c. 1500 N d. 2000 N e. none of the above

68. _____ An object has a constant mass. A constant net force on the object produces constant
a. velocity b. acceleration c. both a and b d. none of these

69. _____ A girl pulls a 10 kg wagon with a constant net force of 30 N. What is the wagon's acceleration?
a. 0.3 m/s/s b. 3.0 m/s/s c. 10 m/s/s d. 30 m/s/s e. 300 m/s/s

70. _____ A tow truck exerts a net force of 3000 N on a car, accelerating it at 2 $m/s^2$. What is the mass of the car?
a. 500 kg b. 1000 kg c. 1500 kg d. 2000 kg e. none of the above

*Problems 71 to 75 refer to the following:*
A 3 kg box is being pulled to the right by an applied force of 40 N at an angle of 25° above the horizontal. The box is accelerating at 3.5 $m/s^2$.




71. _____ What is the net force acting on the box?
a. 10.5 N. b. 36.3 N. c. 25.8 N d. 30 N. e. 13.1 N.

72. _____ What is the horizontal component of the applied force?
a. 10.5 N. b. 36.3 N. c. 25.8 N d. 30 N. e. 13.1 N.

73. _____ What is the force of friction acting on the box?
a. –10.5 N. b. –36.3 N. c. –25.8 N d. –30 N. e. –13.1 N.

74. _____ What is the weight of the box?
a. 10.5 N. b. 36.3 N. c. 25.8 N d. 30 N. e. 13.1 N.

75. _____ What is the normal force acting on the box?
a. 10.5 N. b. 36.3 N. c. 25.8 N d. 30 N. e. 13.1 N.

## Newton's 3rd Law & Momentum

76. _____ When a football is kicked, the action and reaction pairs do not cancel each other because
a. they are not truly equal and opposite.
b. they are equal and opposite, but not at the same time.
c. they act on different objects (the kicker's foot and the ball)
d. the kicker's force on the ball is larger than the ball's force on the kicker.

77. _____ As a ball falls, the action force is the pull of the earth's mass on the ball. What is the reaction to this force?
a. Air resistance acting against the ball.
b. The acceleration of the ball.
c. The pull of the ball's mass on the earth.
d. Nonexistent in this case.
e. None of the above.

# Mid Year Review

78. _____ A person is attracted to the center of the earth by a 500 N gravitational force. The force with which the earth is attracted to the person is
a. very very small. b. very very large. c. 500 N.

79. _____ A player catches a ball. Consider the action force to be the impact of the ball against the player's glove. What is the reaction to this force?
a. The player's grip on the glove.
b. The force the glove exerts on the ball.
c. Friction of the ground against the player's shoes.
d. The muscular effort in the player's arms.
e. none of the above.

80. _____ A Mack truck and a Volkswagen traveling at the same speed have a head on collision. The vehicle which undergoes the greater change in velocity will be the
a. Volkswagen b. Mack truck c. both the same

81. _____ A Mack truck and a Volkswagen traveling at the same speed have a head on collision. The impact force is greatest on the
a. Volkswagen b. Mack truck c. is the same for both

82. _____ A ball with a momentum of 5 kg·m/s crashes into a second ball initially at rest. If the first ball has a momentum of 3 kg·m/s after the crash, what is the momentum of the second ball after the crash?
a. 2 kg·m/s. b. 3 kg·m/s. c. 5 kg·m/s. d. need the masses to calculate.

83. _____ A 3 kg object crashes with an initial momentum of 5 kg·m/s crashes and sticks to a 2 kg object initially at rest. What is the momentum of the combined masses right after the crash?
a. 2 kg·m/s. b. 3 kg·m/s. c. 5 kg·m/s. d. 45 kg·m/s. e. 22.5 kg·m/s.

84. _____ Imagine you are standing still in the hallway when you suddenly decide to run down the hall. From where did you gain your momentum?
a. It was potential momentum stored in your body.
b. Your muscles created the momentum.
c. You got your momentum from the earth when you pushed the earth backwards.
d. It was momentum you had before you stopped in the hallway.

85. _____ A 250 kg cannon fires a 2 kg cannonball with a speed of 300 m/s. What is the recoil speed of the cannon?
a. 2.4 m/s. b. 1.2 m/s. c. 0.833 m/s. d. 37,500 m/s. e. 1.67 m/s.

86. _____ What impulse is needed to stop a 3 kg object with a momentum of 15 kg·m/s?
a. –45 N·s. b. –15 N·s. c. –5 N·s. d. it depends on the force.

87. _____ During an inelastic collision, what is conserved?
a. momentum. b. force. c. time. d. impulse. e. acceleration.

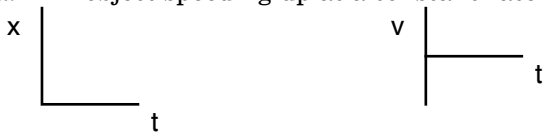
88. _____ A 4 kg object traveling at 8 m/s is given an impulse of 40 N·s. What is its final velocity?
a. 48 m/s. b. 12 m/s. c. 2 m/s. d. 8 m/s. e. 18 m/s.

89. _____ A 4kg object traveling at 8 m/s is given an impulse of –40 N·s. What is its final velocity?
a. –2 m/s. b. –8 m/s. c. –18 m/s. d. –12 m/s. e. –48 m/s.

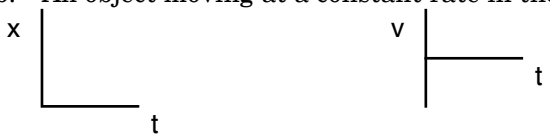
# Mid Year Review

**Problem Solving:** Show your work. Include the correct units in each answer.

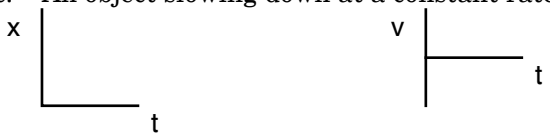
1. Sketch the following (d vs. t, v vs. t) graphs.
   a. An object speeding up at a constant rate in the positive direction.



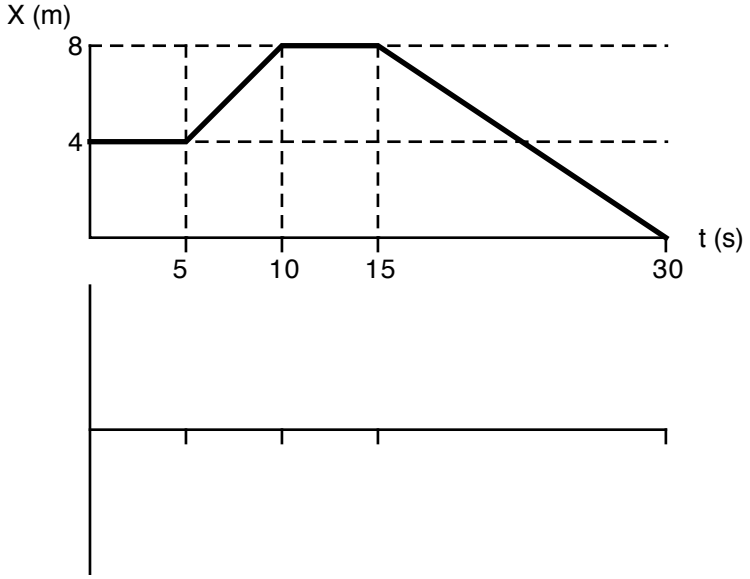

   b. An object moving at a constant rate in the positive direction.




   c. An object slowing down at a constant rate in the positive direction.




2. Describe the motion graphed below and create a corresponding v vs. t graph.

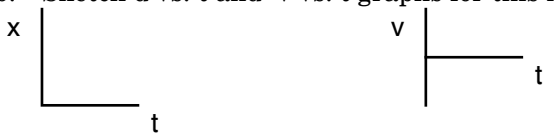



3. A sprinter starts from rest speeds up to a maximum speed and then slows down and comes to rest. Sketch qualitative d vs. t and v vs. t graphs that describe this motion.


4. A small car travels from rest to a speed of 25 m/s in 20 s.
   a. Calculate the car's acceleration and how far the car travels during the 20 seconds.

# Mid Year Review

b. Sketch d vs. t and v vs. t graphs for this motion.

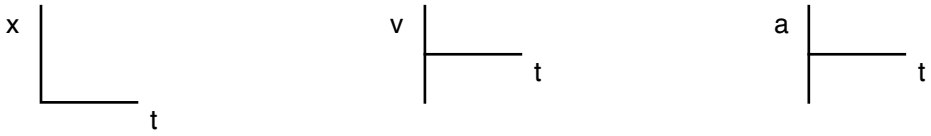



5. A ball is dropped from the top of a 25 m tall building.
   a. How long does it take to hit the ground?

   b. How fast is it moving when it hits the ground?

6. A small 2 kg pumpkin is thrown straight up into the air with a speed of 15 m/s.
   a. How high does the pumpkin go?

   b. Sketch d vs. t, v vs. t and a vs. t graphs for this motion. (Ball toss graphs)




7. Marcia walks 20 m W and then walks 50 m S. What is Marcia's resultant displacement? Include a sketch that shows how you added the vectors.

8. A puppy takes off after a squirrel. The x component of its velocity is 2.5 m/s and the y component of its velocity is 3.5 m/s. It runs for 20 seconds.
   a. How fast is the puppy running?

   b. What are the x and y components of its displacement at the end of the 20 seconds?

   c. How far away from its starting point is the puppy at the end of the 20 seconds?

# Mid Year Review

9. A river is flowing due East with a current of 2 m/s. It is also 50 meters wide. You have a boat that can only travel at 3 m/s in the water. (The throttle is broken and you haven't fixed it yet.)
   a. What is the fastest possible speed you could have with respect to people on the shore? Which way should you point the boat?

   b. What is the slowest possible speed you could have with respect to people on the shore? Which way should you point the boat?

   c. Now you point the boat straight across the river. What is your resultant speed in this case?

   d. With the boat pointed straight across the river, how long will it take you to cross the river?

   e. How far downstream will you travel in that time?

10. A ball rolls off a 2 m high table with a speed of 3 m/s.
   a. How long was the ball in the air?

   b. How far away (horizontally) did the ball land?

   c. Describe what happens to the components of the velocity of the ball while it is falling.

11. A small ball is kicked on a level surface with a speed of 15 m/s at an angle of 20° above the horizontal.
   a. What are the components of the initial velocity?

   b. How long is the ball in the air?

   c. How far away does the ball land?

   d. What was the maximum height of the ball?

# Mid Year Review

12. State Newton's three laws of motion.

13. A 30 kg block is dragged across the floor at a constant velocity with a horizontal applied force of 12 N.
    a. Draw a free body diagram.

    b. What is the net force on the block?

    c. What is the force of friction?

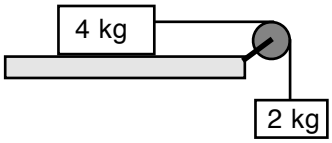
14. A 70 kg crate accelerates from rest to 10 m/s in 2 seconds when a force of 600 N is applied
    a. Draw a free body diagram for the situation. Make sure it is correctly labeled.

    b. Calculate the acceleration of the crate.

    c. Calculate the net force on the crate.

    d. Calculate the force of friction on the crate.

15. A 4kg cart is on a frictionless table and is attached to a hanging 2 kg mass via a pulley as shown in the diagram at right.
    a. What is the applied force on the system?

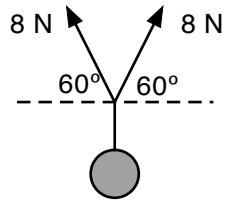



    b. What is the total mass of the system?

    c. What is the acceleration of the system?

# Mid Year Review

16. A mass is hanging from two strings as shown in the diagram to the right. The tension in each string is 8 N, and they are pulling up at an angle of 60°.




    a. What are the horizontal components of the tensions?

    b. What are the vertical components of the tensions?

    c. Which components cancel each other out?

    d. Which components add up?

    e. What is the mass of the hanging object?

17. Beth (65 kg) is sitting on a lab cart (25 kg) at rest. If she jumps off with a speed of 2 m/s, what is the resultant velocity of the lab cart?

18. A 1.5 kg cart moving at 2 m/s collides and sticks to a second cart initially at rest. Together, the two carts have a speed of 1.25 m/s after the collision. What was the mass of the second cart?

19. A 2 kg cart moving at 2 m/s collides with a 3 kg cart at rest. If the 2 kg cart is moving <u>backwards</u> at 0.5 m/s after the collision, calculate the final velocity of the 3 kg cart.

20. During a class Egg Drop Competition, a 0.12 kg egg drop device hits the ground with a speed of 5 m/s and comes to rest in 0.1 s.
    a. What is the change in momentum of the device?

    b. What force acts on the device?