Review session

- I will go through a list of the problems. You will rate the problems in according to your desire to see that problem worked. Then I will do the most highly rated problems first and will work through them in order of priority until the review session is finished.
From dimensional analysis, mark these formulas as either 'valid' or 'invalid'. Assume that $x$ has dimensions of distance, $v$ has dimensions of velocity, $t$ has dimensions of time, $g$ has dimensions of acceleration and $m$ has dimensions of mass.

$\triangleright \frac{m(x + vt)}{(1 + gt)} = \frac{mgt^2}{2}$

1. A ○ valid  B ○ invalid

$\triangleright \frac{vt}{x} = \frac{7}{2}$

2. A ○ valid  B ○ invalid
Consider the plot of position vs. time below.

- The acceleration is negative in region ____.
  7. A  B  C  D  E  F

- The velocity is uniform and positive in region ____.
  8. A  B  C  D  E  F

- The acceleration is positive in region ____.
  9. A  B  C  D  E  F

- The velocity is uniform and negative in region ____.
  10. A  B  C  D  E  F
A car is initially at rest on a straight road. The histogram below shows the car's acceleration along that road as a function of time.

- Calculate the speed of the car at t = 3 s.
- Calculate the distance traveled during the first 6 s.
- Calculate the distance traveled from t=11 s to t=13 s.
- Calculate the car's average speed from t = 5 s to t=9 s.
3. A rock is thrown straight down with an initial velocity of 14.5 m/s from a cliff. What is the rock’s displacement after 2.0 s? (Acceleration due to gravity is 9.80 m/s².)
   
a. 28 m  
b. 49 m  
c. 55 m  
d. 64 m

4. A rock is thrown straight up with an initial velocity of 24.5 m/s. What maximum height will the rock reach before starting to fall downward? (Take acceleration due to gravity as 9.80 m/s².)
   
a. 9.80 m  
b. 19.6 m  
c. 24.5 m  
d. 30.6 m

5. A rock is thrown straight up with an initial velocity of 19.6 m/s. What time interval elapses between the rock’s being thrown and its return to the original launch point? (Acceleration due to gravity is 9.80 m/s².)
   
a. 4.00 s  
b. 5.00 s  
c. 8.00 s  
d. 10.0 s
8. A bird, accelerating from rest at a constant rate, experiences a displacement of 28 m in 11 s. What is the average velocity?

   a. 1.7 m/s  
   b. 2.5 m/s  
   c. 3.4 m/s  
   d. zero

10. A bird, accelerating from rest at a constant rate, experiences a displacement of 28 m in 11 s. What is its acceleration?

   a. 0.21 m/s²  
   b. 0.46 m/s²  
   c. 0.64 m/s²  
   d. 0.78 m/s²

25. At the top of a cliff 100 m high, Raoul throws a rock upward with velocity 15.0 m/s. How much later should he drop a second rock from rest so both rocks arrive simultaneously at the bottom of the cliff?

   a. 5.05 s  
   b. 3.76 s  
   c. 2.67 s  
   d. 1.78 s
27. An $x$ vs. $t$ graph is drawn for a ball moving in one direction. The graph starts at the origin and at $t = 5$ s the velocity of the ball is zero. We can be positive that at $t = 5$ s,

a. the slope of the curve is non-zero.
b. the ball has stopped.
c. the acceleration is constant.
d. the curve is at $x = 0, t = 0$.

28. A $v$ vs. $t$ graph is drawn for a ball moving in one direction. The graph starts at the origin and at $t = 5$ s the acceleration of the ball is zero. We know that at $t = 5$ s,

a. the slope of the curve is non-zero.
b. the velocity of the ball is not changing.
c. the curve is not crossing the time axis.
d. the curve is at $v = 0, t = 0$.

40. A parachutist jumps out of an airplane and accelerates with gravity to a maximum velocity of 58.8 m/s in 6.00 seconds. She then pulls the parachute cord and after a 4.00-second constant deceleration, descends at 10.0 m/s for 60.0 seconds, reaching the ground. From what height did the parachutist jump?

a. 914 m
b. 1 130 m
c. 1 520 m
d. 1 750 m
43. A ball is thrown vertically upwards at 19.6 m/s. For its complete trip (up and back down to the starting position), its average velocity is

   a. 19.6 m/s
   b. 9.80 m/s
   c. 4.90 m/s
   d. not given

13. A student adds two vectors with magnitudes of 200 and 40. Which one of the following is the only possible choice for the magnitude of the resultant?

   a. 100
   b. 200
   c. 260
   d. 40
24. A baseball thrown from the outfield is released from shoulder height at an initial velocity of 29.4 m/s at an initial angle of 30.0° with respect to the horizontal. If it is in its trajectory for a total of 3.00 s before being caught by the third baseman at an equal shoulder-height level, what is the ball’s net vertical displacement during its 3-s trajectory?

   a. 11.0 m
   b. 9.80 m
   c. 22.1 m
   d. zero

25. A baseball thrown from the outfield is released from shoulder height at an initial velocity of 29.4 m/s at an initial angle of 30.0° with respect to the horizontal. What is the maximum vertical displacement that the ball reaches during its trajectory?

   a. 11.0 m
   b. 9.80 m
   c. 22.1 m
   d. 44.1 m
26. A baseball is thrown by the center fielder (from shoulder level) to home plate where it is caught (on the fly at an equal shoulder level) by the catcher. At what point is the ball’s speed at a minimum? (air resistance is negligible)

   a. just after leaving the center fielder’s hand
   b. just before arriving at the catcher’s mitt
   c. at the top of the trajectory
   d. speed is constant during entire trajectory

32. A stone is thrown at an angle of $30^\circ$ above the horizontal from the top edge of a cliff with an initial speed of 12 m/s. A stop watch measures the stone’s trajectory time from top of cliff to bottom to be 5.6 s. What is the height of the cliff? ($g = 9.8 \text{ m/s}^2$ and air resistance is negligible)

   a. 58 m
   b. 154 m
   c. 120 m
   d. 197 m

33. A stone is thrown at an angle of $30^\circ$ above the horizontal from the top edge of a cliff with an initial speed of 12 m/s. A stop watch measures the stone’s trajectory time from top of cliff to bottom to be 5.6 s. How far out from the cliff’s edge does the stone travel horizontally? ($g = 9.8 \text{ m/s}^2$ and air resistance is negligible)

   a. 58 m
   b. 154 m
   c. 120 m
   d. 197 m
36. A stone is thrown with an initial speed of 15 m/s at an angle of 53° above the horizontal from the top of a 35 m building. If \( g = 9.8 \text{ m/s}^2 \) and air resistance is negligible, then what is the speed of the rock as it hits the ground?

a. 15 m/s  
b. 21 m/s  
c. 30 m/s  
d. 36 m/s

43. A boat moves at 10.0 m/s relative to the water. If the boat is in a river where the current is 2.00 m/s, how long does it take the boat to make a complete round trip of 1000 m upstream followed by a 1000-m trip downstream?

a. 200 s  
b. 203 s  
c. 208 s  
d. 250 s

47. A baseball leaves the bat with a speed of 44.0 m/s and an angle of 30.0° above the horizontal. A 5.0-m-high fence is located at a horizontal distance of 132 m from the point where the ball is struck. Assuming the ball leaves the bat 1.0 m above ground level, by how much does the ball clear the fence?

a. 4.4 m  
b. 8.8 m  
c. 13.4 m  
d. 17.9 m
1 pt  After landing, a jet airplane comes to rest uniformly (the acceleration is constant) in 9.1 seconds. The landing speed of the aircraft is 188 km/hour. How far, in m, does the aircraft roll?

15. A  173.7  B  203.2  C  237.8  D  278.2  
   E  325.5  F  380.9  G  445.6  H  521.4
51. Vector $\mathbf{A}$ is 3 m long and vector $\mathbf{B}$ is 4 m long. The length of the sum of the vectors is

   a. 5 m.
   b. 7 m.
   c. 12 m.
   d. some value from 1 m to 7 m.

52. When three vectors are added graphically and form a closed triangle, the largest enclosed angle between any two of the vectors cannot be greater than

   a. $60^\circ$
   b. $90^\circ$
   c. $180^\circ$
   d. no maximum exists
5. Two ropes are attached to a 40-kg object. The first rope applies a force of 25 N and the second, 40 N. If the two ropes are perpendicular to each other, what is the resultant acceleration of the object?

   a. 1.2 m/s²  
   b. 3.0 m/s²  
   c. 25 m/s²  
   d. 47 m/s²  

20. A 15-kg block rests on a level frictionless surface and is attached by a light string to a 5.0-kg hanging mass where the string passes over a massless frictionless pulley. If \( g = 9.8 \text{ m/s}^2 \), what is the tension in the connecting string?

   a. 65 N  
   b. 17 N  
   c. 49 N  
   d. 37 N  

24. A 300-kg crate is placed on an adjustable inclined plane. As one end of the incline is raised, the crate begins to move downward. If the crate slides down the plane with an acceleration of 0.70 m/s² when the incline angle is 25°, what is the coefficient of kinetic friction between ramp and crate? (\( g = 9.8 \text{ m/s}^2 \))

   a. 0.47  
   b. 0.42  
   c. 0.39  
   d. 0.12
47. A 5000-N weight is suspended in equilibrium by two cables. Cable 1 applies a horizontal force to the right of the object and has a tension, $T_1$. Cable 2 applies a force upward and to the left at an angle of 37.0° to the negative $x$ axis and has a tension, $T_2$. Find $T_2$.

   a. 4000 N
   b. 6640 N
   c. 8310 N
   d. 3340 N

53. A 500-N tightrope walker stands at the center of the rope. If the rope can withstand a tension of 1800 N without breaking, what is the minimum angle the rope can make with the horizontal?

   a. 4°
   b. 8°
   c. 10°
   d. 15°
59. A karate master strikes a board with an initial velocity of 10.0 m/s, decreasing to 1.0 m/s as his hand passes through the board. If the time of contact with the board is 0.0020 s, and the mass of the coordinated hand and arm is 1.0 kg, what is the force exerted on the board?

a. 1 000 N  
b. 1 800 N  
c. 2 700 N  
d. 4 500 N

63. An automobile of mass 2 000 kg moving at 30 m/s is braked suddenly with a constant braking force of 10 000 N. How far does the car travel before stopping?

a. 45 m  
b. 90 m  
c. 135 m  
d. 180 m