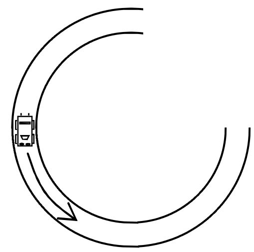
2012 PreAP Energy 10

1. A 200 W motor acts on a 30 N object for 6 seconds.
   A. *What is the mass of the object?
   B. *Using the equation for power, calculate the work done.
   C. If the object begins at rest, how fast is the object moving afterwards?

2. A. * A motor can produce 100W. How high can it lift a 15 kg object in 2 minutes?

   B. If the motor was more powerful how would the above problem change?

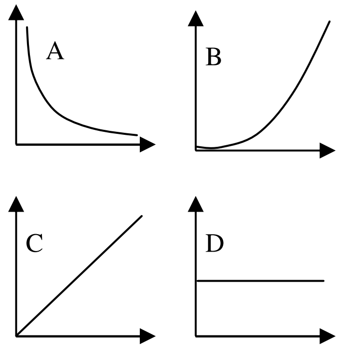
3. A 1200 kg car is driving 15 m/s around a curve that has a 65 m radius.



   A. * Calculate the centripetal acceleration of the car.
   B. What force provides this acceleration?
   C. * What is the direction of this force?
   D. * What is the direction of its velocity?
   E. What is the angle between the force and velocity?
   F. If the force is 250N calculate the work it does in 10 m.

   G. So, why does the moon not fall into the earth?

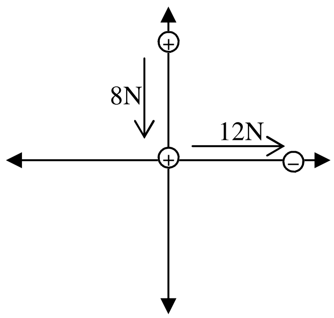
4. Use the different energy equations to answer the following proportionality questions.
   A. * If you triple the mass of an object, but how much does its gravitational potential energy change?
   B. * If you double the velocity of an object, by how much does the potential energy change?
   C. If you compress a spring half as far, but how much does the potential elastic energy change?
   D. If you double the spring constant, by how much does the potential elastic energy change?
   E. If an object gains the same amount of potential energy in half the time, by how much did the power change?



5. Which graph shows the following? (*If you don't remember the function shapes, refer to: "How to Straighten Graphs".*)
   A. _____ * Kinetic energy vs. velocity.
   B. _____ Gravitational potential energy vs. mass.
   C. _____ Elastic potential energy vs. spring constant.
   D. _____ Power vs. Time
   E. _____ * Kinetic energy vs. time
   F. _____ Elastic potential energy vs. displacement.
   G. _____ Gravitational potential energy vs. height
   H. _____ Work vs. force.

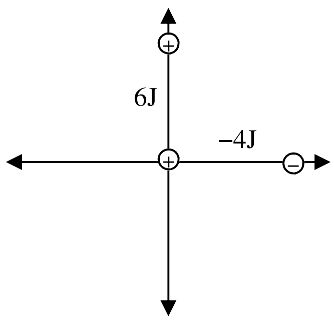
More on back.

Getting ahead with scalars vs. vectors...



6. Three charges are aligned as shown at the left. The + charge at the origin is movable, but the others are fixed. Notice that the charge at the origin is repelled by the other + charge and attracted by the − charge.
   A. Use an arrow to show the net force acting on the movable charge.

   B. Knowing that forces are vectors, calculate the net force on the charge at the origin (give both magnitude and direction).



7. The same configuration is shown, but this time with the potential energies given.
   A. What is conspicuously missing on this diagram?
   B. Why?
   C. * Calculate the total energy of the charge at the origin.

Why is one energy positive and the other negative? To bring the + charge to the origin from infinity would require + work, like compressing a spring, since the two +'s repel each other. If released the + charge at the origin would fly off. Since it would gain KE, it must have PE. To move the + charge from infinity toward the − charge would require − work, since it WANTS to move closer: it is attracted, so you would have to hold back the − charge, reducing the amount of KE it could have. OR your force would be away from the − charge (holding it back) and the displacement is toward the − charge. Since F and d are in opposite direction: negative work. OR won't it have more PE far from the − charge than close up? If released from infinity it would have a longer distance to accelerate, so it has LESS possible KE here (so less PE) than if released from infinity.

1A) Isn't Newtons weight and weight = mg? 1B) P = W/t, so W = Pt OR P = [J/s] so [J] = [Watts•sec] = 1200 J.
2A) 80 m
3A) remember that centripetal acc = v^2/r 3C) toward center 3D) forward (tangential)
4A) Since PE = mgh, if m triples, PE triples (no powers, etc) 4B) no v in mgh
5A) graph B, since v is squared 5E) graph D, since there is no time in KE.