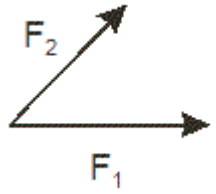
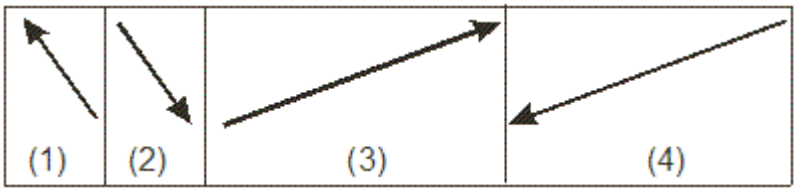
Unit 2: Name: _____

Use the following to answer question 1:

The figure below shows two forces, F_1 and F_2, acting on an object.



Use the vector diagrams to answer the question below.



1. A third force is applied on the object so that the net force on the object is zero. Which force vector best represents the third force?
   A) (1) B) (2) C) (3) D) (4) E) none of the vectors

2. A vertical rope is attached to an object that has a mass of 40.0 kg and is at rest. The tension in the rope needed to give the object an upward speed of 3.50 m/s in 0.700 s is
   A) 592 N B) 390 N C) 200 N D) 980 N E) 720 N

3. A cricket batsman hits a ball with a bat. If the force with which the bat hits the ball is considered the action force, what is the reaction force?
   A) the force the bat exerts on the batsman's hands
   B) the force on the ball exerted by the hand of the person who catches it
   C) the force the ball exerts on the bat
   D) the force the bowler exerts on the ball in throwing it
   E) friction as the ball rolls to a stop

4. A block of wood is pulled by a horizontal string across a rough surface at a constant velocity with a force of 20 N. The coefficient of kinetic friction between the surfaces is 0.3. The force of friction is
   A) impossible to determine without knowing the mass of the block.
   B) impossible to determine without knowing the speed of the block.
   C) 0.3 N
   D) 6 N
   E) 20 N

5. A particle moving with uniform Motion Along a Circular Path has a period of 0.24 s and a speed of 4.2 m/s. The radius of the path of the particle is
   A) 16 cm B) 2.6 cm C) 1.0 m D) 0.062 cm E) 1.4 cm

6. A bullet with a mass of 12 g moving horizontally strikes a fixed block of wood and penetrates a distance of 5.2 cm. The speed of the bullet just before the collision was 640 m/s. The magnitude of the average force that the wood exerted on the bullet was
   A) 4.7×10^4 N
   B) 74 N
   C) 4.7×10^6 N
   D) unknown; the mass of the wood is required
   E) None of these is correct.

7. Two forces, both of magnitude 12 N and directed 35 degrees either side of the direction of motion, pull a crate 15 m. How much work is done by the forces in moving the crate?
   A) 1.8×10^2 J
   B) 1.5×10^2 J
   C) 2.9×10^2 J
   D) 2.9×10^2 N/m
   E) 2.1×10^2 J

8. Power P is required to lift a body a distance d at a constant speed v. What power is required to lift the body a distance $2d$ at constant speed $3v$?
   A) P B) $2P$ C) $3P$ D) $6P$ E) $3P/2$

9. Susana ascends a mountain via a short, steep trail. Sean ascends the same mountain via a long, gentle trail. Which of the following statements is true?
   A) Susana gains more gravitational potential energy than Sean.
   B) Susana gains less gravitational potential energy than Sean.
   C) Susana gains the same gravitational potential energy as Sean.
   D) To compare energies, we must know the height of the mountain.
   E) To compare energies, we must know the lengths of the two trails.

10. Which of the following statements is true?
    A) The kinetic and potential energies of an object must always be positive quantities.
    B) The kinetic and potential energies of an object must always be negative quantities.
    C) Kinetic energy can be negative but potential energy cannot.
    D) Potential energy can be negative but kinetic energy cannot.
    E) None of these statements is true.

11. **(SHOW ALL WORK)** A block of mass 4 kg rests on a horizontal surface and is accelerated by means of a horizontal cord that passes, without friction, over a motionless peg to a hanging weight of mass 8 kg. The coefficient of kinetic friction between the block and the horizontal surface is 0.2 and the tension in the cord is T. Take $g = 10 m/s^2$ and use metric units to answer parts (a) – (c) in terms of only T and numbers.

(a) What is the net force on the hanging weight (with downward positive)?

(b) What is the net horizontal force on the 4 kg block?

(c) What is the net vertical force on the 4 kg block?

(d) Find the numerical value of T (showing its units).

Answer Key

1. D the opposite of $F_1 + F_2$
2. A $T - 40kg(9.81m/s^2) = 40kg(3.50m/s / 0.700s)$ $T = 592N$
3. C the force the ball exerts on the bat
4. E $20N - f = m \cdot 0$ $f = 20N$
5. A $4.2m/s = 2\pi r/0.24s$ $r = .16m$
6. A $F \cdot .052m = 0 - \frac{1}{2} \cdot .012kg\ (640m/s)^2$ $F = -4.7 \times 10^4\ N$
7. C $2(12N \cdot \cos 35^o \cdot 15m) = 2.9 \times 10^2\ J$
8. C $P = Fv = mgv$ $P_{new} = mg3v = 3P$
9. C Susana gains the same gravitational potential energy as Sean.
10. D Potential energy can be negative but kinetic energy cannot.

11. (a) $8kg \cdot 10m/s^2 - T = 80 - T$
    (b) $T - .2 \cdot 4kg \cdot 10m/s^2 = T - 8$
    (c) 0 (no vertical accel.)
    (d) $(80 - T)/8 = (T - 8)/4$ $T = 32N$