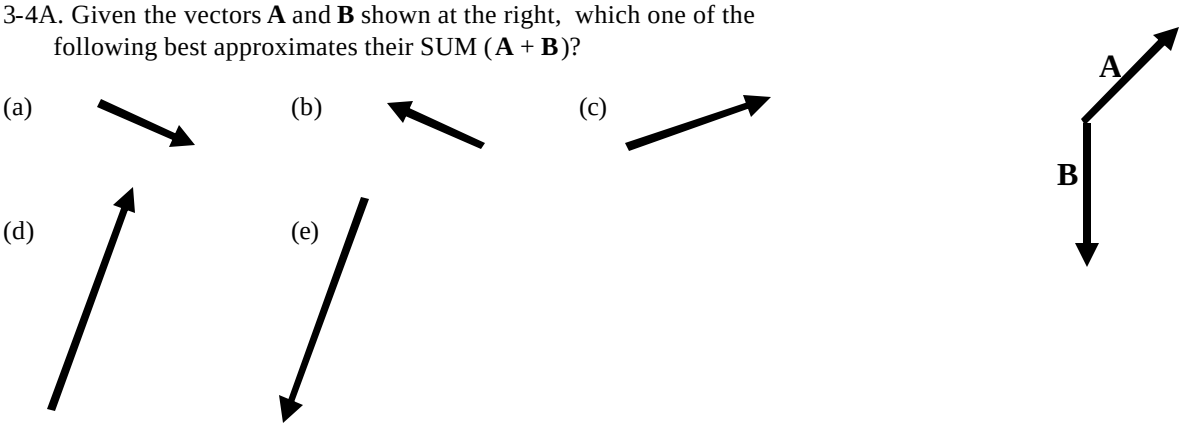
3-1A. Which of the following are vectors? (a) acceleration, (b) time; (c) speed; (d) displacement; (e) velocity?
(a) All five. (b) acceleration, speed, time. (c) speed, displacement, velocity. (d) acceleration, time, displacement.
(e) acceleration, displacement, velocity.

3-2A. A woman is walking at a speed of 2 m/s North along the deck of a boat that is sailing on a river. The boat is moving parallel to the shore at a speed of 5 m/s North relative to the shore. With what speed is the woman on the boat moving relative to the shore?
(a) 2 m/s north (b) 3 m/s north (c) 5 m/s north (d) 7 m/s north (e) None of these is close.

3-3A. A small plane is on a compass heading due north (N). In no wind, its speed would be 80 km/hour. If a strong wind is blowing from E to W at 80 km/h, about what is the speed of the plane relative to the ground?
(a) 80 km/h (b) 110 km/h (c) 11 (d) 160 km/h (e) None of these is even close.

3-4A. Given the vectors **A** and **B** shown at the right, which one of the following best approximates their SUM (**A** + **B**)?



Use the following information for both problems 3-5A and 3-6A. A man in a rowboat wants to cross a 400 m wide river that flows at a fixed rate = 1 km/hr. He can row in still water at maximum speed of 2 km/hr.

3-5A. What is the shortest time in which he can get to the other side?
(a) 0.4 hr (b) 0.2 hr (c) 1 hr (d) 200 hr (e) 0.13 hr

3-6A If, instead, he wants to cross the river to the point directly opposite his starting point, at about what angle to the perpendicular to the parallel shores should he person row the boat?
(a) 0^o (b) 20^o (c) 30^o (d) 45^o (e) 60^o

3.7A. Which one of the following statements is wrong?
(a) It is possible for the magnitude of the difference between two vectors to be bigger than either vector alone.
(b) Neglecting air resistance, a projectile has it minimum speed at the top of its parabolic arc.
(c) A boy, sitting in a train moving forward with constant velocity, throws a ball straight upward into the air. Because the boy and the train are moving forward, the ball will not fall back into his hand.
(d) If the acceleration of a body is constant in a given reference frame, then it must be constant at the same value in any reference frame moving with constant velocity relative to the first frame.
(e) To get to the other side of a flowing river most quickly, you should row directly toward the other shore.

3-8A. A diver leaps horizontally with a speed v = 10 m/s from a cliff of height 20 m.
Neglecting air resistance, about how far away from the cliff should she hit the water?
(a) 4 m (b) 20 m (c) 100 m (d) 15 m (e) 10 m

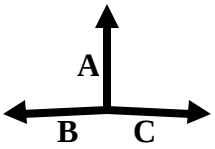
3-9A. About what will be the speed of the diver in problem 3-8A when she hits the water?
(a) 40 m/s (b) 10 m/s (c) 30 m/s (d) 22 m/s (e) None of these is close.

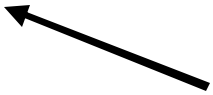
3-10A. A rifle is aimed at a target 100 m away. If it shoots a bullet horizontally at a speed of 500 m/sec, about how far does the bullet 'fall' from the horizontal as it travels the 100 m to the target? Neglect air friction.
(a) 10 m (b) 0.4 m (c) 0.2 m (d) 0.1 m (e) 0.02 m

3-11A. On planet P, the acceleration due to gravity is only one quarter that on Earth, $g_P = (1/4)g_E$. If an object on P drops from rest and falls to the Planet surface from a given height, what is the ratio t_P/t_E of the time t_P it takes to reach the Planet's surface to the time t_E it would take to fall the same distance to the surface of the Earth/
(a) $t_P = t_E$ (b) $t_P = 2t_E$ (c) $t_P = (1/2)t_E$ (d) $t_P = 4t_E$ (e) $t_P = (1/4)t_E$

3.12A. Which one of the following vectors is closest to the sum of the three vectors **A**, **B**, and **C** shown at the right?

(a) 
(b) 
(c) 



(d) 
(e) 

3-13A. Which one of the following statements is wrong about a projectile shot from the ground and returning to the ground? Neglect air resistance.
(a) The larger the vertical component of the projectile's initial velocity, the higher it will rise.
(b) For fixed launch speed, the distance the projectile travels horizontally depends on the angle of launch.
(c) The time of flight depends only upon the vertical component of the projectile's initial velocity.
(d) The projectile's speed at the top of its trajectory depends only on the horizontal component of its initial velocity.
(e) For fixed launch speed, the speed of the projectile when it hits the ground depends upon the launch angle.

For problems 3-14A to 3-19A, assume that a projectile is shot from the ground with speed 50 m/s at an angle of 53.1^o above the horizontal and returns to the ground. Neglect air resistance.

3-14A. How long does it take the projectile to reach the top of its path?
(a) 1 sec (b) 4 sec (c) 2 sec (d) 3 sec (e) 5 sec

3-15A. What is the projectile's speed at the top of its path?
(a) 50 m/s (b)40 m/s (c) 30 m/s (d) 20 m/s (e) 10 m/s

3-16A. How high above the ground does the projectile rise?
(a) 100 m (b) 420 m (c) 120 m (d) 160 m (e) 80 m

3-17A. How long from its start does it take the projectile to return to the ground?
(a) 8 sec (b) 2 sec (c) 10 sec (d) 6 sec (e) 4 sec

3-18A. How far from its starting place does the projectile hit the ground?
(a) 320 m (b) 120 m (c) 240 m (d) 480 m (e) None of these is close.

3-19A. What is the projectile's speed just before it hits the ground?
(a) 30 m/s (b) 40 m/s (c) 20 m/s (d) 50 m/s (e) 100 m/s

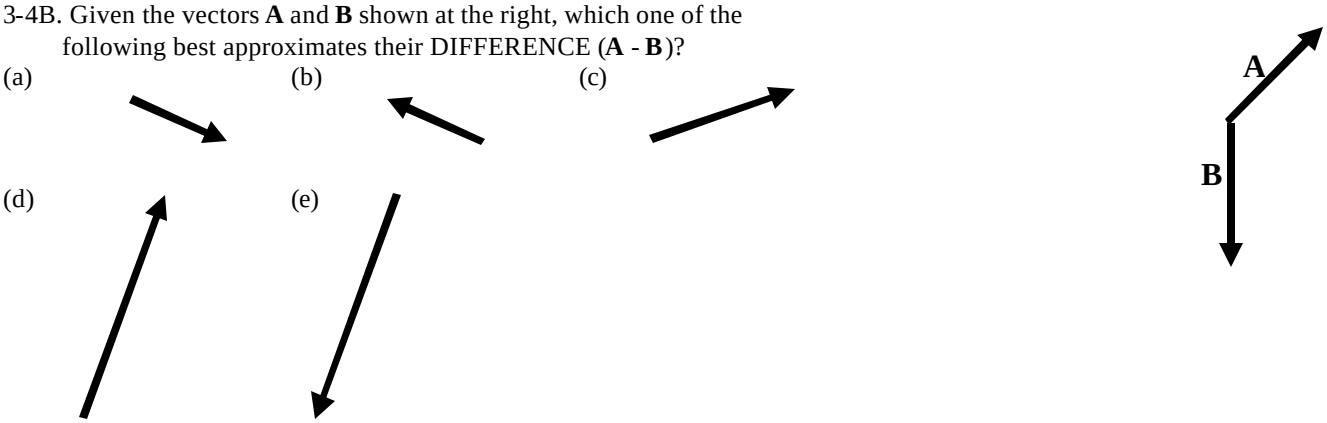
.

3.1B. Which ones of the following are vectors? (a) velocity, (b) distance, (c) acceleration, (d) displacement, (e) time.
(a) All five. (b) velocity, distance, acceleration, displacement. (c) acceleration, time, velocity. (d) velocity, acceleration, displacement. (e) distance, acceleration, displacement.

3.2B. A woman is walking at a speed of 2 m/s South along the deck of a boat that is sailing on a river. The boat is moving parallel to the shore at a speed of 5 m/s North relative to the shore. With what speed is the woman on the boat moving relative to the shore?
(a) 2 m/s south (b) 3 m/s north (c) 7 m/s north (d) 3 m/s south (e) None of these is close.

3-3B. A small plane is on a compass heading due north (N). In no wind, its speed would be 80 km/hour. If a strong wind is blowing from E to W at 60 km/h, about what is the speed of the plane relative to the ground?
(a) 80 km/h (b) 140 km/h (c) 100 km/h (d) 20 km/h (e) None of these is close.

3-4B. Given the vectors **A** and **B** shown at the right, which one of the following best approximates their DIFFERENCE (**A** - **B**)?



Use the following information for both problems 3-5B and 3-6B. A girl in a rowboat wants to cross a 2 km wide river that flows at a fixed rate = 3 km/hr. She can row at 5 km/hr in still water

3-5B. What is the shortest time in which she can get to the other side?
(a) 0.4 hr (b) 0.2 hr (c) 0.66 hr (d) 0.5 hr (e) 0.33 hr

3-6B If, instead, she wants to cross the river to the point directly opposite her starting point, at about what angle to the perpendicular to the parallel shores should she row the boat?
a) 30^o b) 37^o c) 45^o d) 53^o e) 60^o

3.7B. Which one of the following statements is wrong?
(a) It is impossible for the magnitude of the difference between two vectors to be bigger than either vector alone.
(b) Neglecting air resistance, a projectile has it minimum speed at the top of its parabolic arc.
(c) A boy, sitting in a train moving forward with constant velocity, throws a ball straight upward into the air. Because the boy and the train are moving forward with the same speed, the ball should fall back into his hand.
(d) If the acceleration of a body is constant in a given reference frame, then it must be constant at the same value in any reference frame moving with constant velocity relative to the first frame.
(e) To get to the other side of a flowing river most quickly, you should row directly toward the other shore.

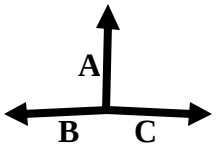
3-8B. A projectile is shot forward horizontally with a speed v = 30 m/s from a cliff of height 45 m. Neglecting air resistance, about how far away from the cliff should the projectile hit the ground?
(a) 90 m (b) 405 m (c) 135 m (d) 900 m (e) None of these is close.

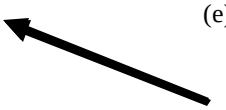
3-9B. What will be the speed of the projectile in problem 3-8B when it hits the ground?
(a) 30 m/s (b) 42 m/s (c) 60 m/s (d) 90 m/s (e) None of these is close.

3-10B. A rifle is aimed at a target 100 m away. If it shoots a bullet horizontally at a speed of 500 m/sec, about how far does the bullet 'fall' from the horizontal *during the second 50 m* of its travel to the target? Neglect air friction.
(a) 25 m (b) 0.2 m (c) 1 m (d) 0.05 m (e) 0.15 m

3-11B. On Planet P, the acceleration due to gravity is four times that on Earth, $g_P = 4g_E$. If an object on P drops from rest, and falls to the Planet surface from a given height, what is the ratio t_P/t_E of the time t_P it takes to reach the Planet's surface to the time t_E it would take to fall the same distance to the surface of the Earth/
(a) $t_P = t_E$ (b) $t_P = 2t_E$ (c) $t_P = (1/2)t_E$ (d) $t_P = 4t_E$ (e) $t_P = (1/4)t_E$

3.12B. Which one of the following vectors is closest to the vector **A + B - C** constructed from the vectors shown at the right?



(a) 
(b) 
(c) 
(d) 
(e) 

3-13B. Which one of the following statements is wrong about a projectile shot from the ground and returning to the ground? Neglect air resistance.
(a) The larger the vertical component of the projectile's initial velocity, the higher it will rise.
(b) For fixed launch speed, the larger the horizontal component of the projectile's initial velocity, the further it will travel horizontally.
(c) The time of flight depends only upon the vertical component of the projectile's initial velocity.
(d) The projectile's speed at the top of its trajectory depends only upon the horizontal component of its initial velocity.
(e) For fixed launch speed, the speed of the projectile when it hits the ground doesn't depend upon the angle of projection.

For problems 3-14B to 3-19B, assume that a projectile is shot from the ground with speed 100 m/s at an angle of 37^o above the horizontal and returns to the ground. Neglect air resistance.

3-14B. How long does it take the projectile to reach the top of its path?
(a) 6 sec (b) 10 sec (c) 8 sec (d) 3 sec (e) 12 sec

3-15B. What is the projectile's speed at the top of its path?
(a) 60 m/s (b) 100 m/s (c) 40 m/s (d) 80 m/s (e) 20 m/s

3-16B. How high above the ground does the projectile rise?
(a) 360 m (b) 180 m (c) 420 m (d) 300 m (e) 120 m

3-17B. How long from its start does it take the projectile to return to the ground?
(a) 24 sec (b) 20 sec (c) 16 sec (d) 6 sec (e) 12 sec

3-18B. How far from its starting place does the projectile hit the ground?
(a) 240 m (b) 1600 m (c) 480 m (d) 720 m (e) None of these is close.

3-19B. What is the projectile's speed just before it hits the ground?
(a) 200 m/s (b) 50 m/s (c) 100 m/s (d) 60 m/s (e) 80 m/s

3-1A) e 2A) d 3A) b 4A) a 5A) b 6A) c 7A) c 8A) b 9A) d 10A) c 11A) b 12A) a 13A) e 14A) b 15A) c 16A) e 17A) a 18A) c 19A) d.

3-1B) d 2B) b 3B) c 4B) d 5B) a 6B) b 7B) a 8B) a 9B) b 10B) e 11B) c 12B) d 13B) b 14B) a 15B) d 16B) b 17B) e 18B) e 19B) c.