10. A ball is thrown horizontally at 5.5 m/s at the same time that a coin is dropped from the same height as the ball. If it takes the coin 0.25 s to fall to the ground, then the time for the ball to hit the ground is

76% a

a) 0.25 s b) 0.64 s c) 1.00 s d) 1.57 s e) 3.14 s

x + y motions Independent.

11. We have two vectors, $\vec{A} = -2.20\hat{i} + 2.00\hat{j}$ and $\vec{B} = 2.70\hat{i} - 0.800\hat{j}$. What is the angle between the two vectors, in degrees?

$\vec{A}\cdot\vec{B} = AB\cos\theta$ So $\cos\theta = \frac{\vec{A}\cdot\vec{B}}{AB}$

a) 26 b) 42 c) 79 d) 133 e) 154

60% e

$A = \sqrt{(2.20)^2+(2.00)^2} = 2.97$ $B = \sqrt{(2.70)^2+(0.800)^2} = 2.82$

$\vec{A}\cdot\vec{B} = (-2.20)(2.70)+(2.00)(-0.800) = -7.54$, $\theta = \cos^{-1}\left(\frac{-7.54}{(2.97)(2.82)}\right) = 154^\circ$

12. For the two vectors in question 11, what angle does $\vec{A} - \vec{B}$ make to the x-axis?

a) –14 b) –30 c) –60 d) 60 e) –67

56% b

$\vec{A} - \vec{B} = (-2.20 - 2.70)\hat{i} + (2.00 - (-0.800))\hat{j}$

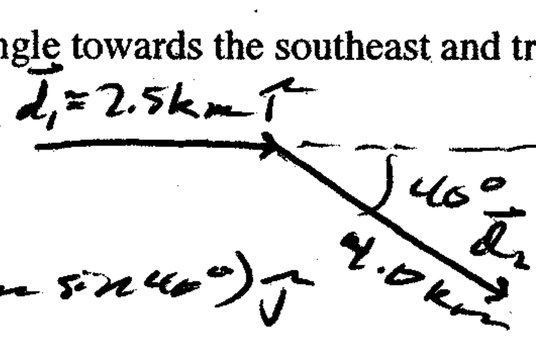
$\vec{A} - \vec{B} = -4.9\hat{i} + 2.8\hat{j}$

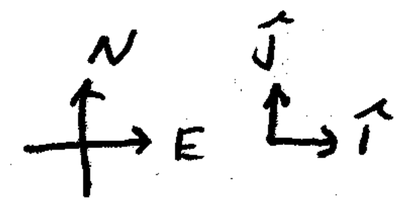
$\theta = \tan^{-1}\left(\frac{2.8}{-4.9}\right) = -30^\circ$

13. A hiker travels 2.5 km east, then turns at a 40 degree angle towards the southeast and travels 4.0 km. The magnitude of the hiker's net displacement is, in km,

56% c

a) 2.6 b) 6.5 c) 6.1 d) 5.1 e) 5.6





C

$\vec{d}_1 = 2.5\text{km}\,\hat{i}$

$\vec{d}_2 = (4.0\text{km}\cos 40^\circ)\hat{i} - (4.0\text{km}\sin 40^\circ)\hat{j}$

$\vec{d}_2 = 3.06\text{km}\,\hat{i} - 2.57\text{km}\,\hat{j}$

$\vec{d}_{net} = \vec{d}_1 + \vec{d}_2 = 5.56\text{km}\,\hat{i} - 2.57\text{km}\,\hat{j}$ $|\vec{d}_{net}| = \sqrt{(5.56)^2+(2.57)^2}\,\text{km} = 6.13\text{km}$

14. Which of the following is not true of the vector cross product of two vectors?

44% C

a) It is proportional to the product of the magnitudes of the two vectors

b) It is perpendicular to both of the vectors

c) It has a magnitude of zero when the vectors are perpendicular to each other.

d) A right-hand rule is used to find the direction of the cross product.

$|\vec{A}\times\vec{B}| = AB\sin\theta$

max at $\theta = 90^\circ$

15. I throw a ball horizontally off of a cliff at a speed of 20 m/s. After it has traveled 45 m horizontally, how much has it dropped vertically, in m?

58% b

a) zero b) 25 c) 20 d) 0.97 e) 50

$V_x = V_{ox} = 20\text{ m/s}$ so $t = \frac{45\text{m}}{20\text{m/s}} = 2.25\text{s}$

$Y_f - Y_i = V_{oy}t - \frac{1}{2}gt^2 = -25\text{m}$

16. A cannon shell fired fom ground level at a 30 degree angle strikes its intended target, which is at the same height as the cannon, after some period of time. Which of the following statements are true?

44% d

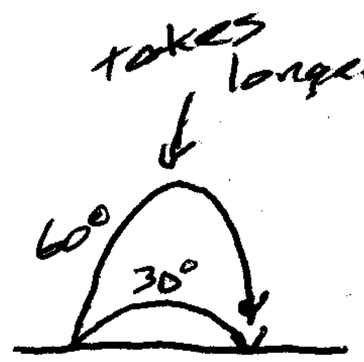
a) The cannon can hit the target with a lower muzzle velocity at an inclination of 15 degrees

b) The cannon can hit the target at the same time, with the same muzzle velocity, when inclined at 60 degrees

c) The cannon can hit the target in less time, with the same muzzle velocity, when inclined at 60 degrees

d) The cannon can hit the target later, with the same muzzle velocity, when inclined at 60 degrees

e) There is a different value of the muzzle velocity for which the cannon can hit the target when inclined at 60 degrees.



17. A clown is fired from a cannon at an angle of 60 degrees above the horizontal at a speed of 15 m/s. The goal is to land him in a net which is 15 m horizontally away from his launch point. At what height in m should the net be so the clown lands in it?

44% e

a) 26 b) 2.1 c) 5.3 d) 20 e) 6.4

$V_{ox} = (15\text{m/s})\cos 60^\circ = 7.5\text{m/s}$

$V_{oy} = (15\text{m/s})\sin 60^\circ = 13.0\text{m/s}$

$R = 15\text{m}$ $t = \frac{R}{V_x} = \frac{15\text{m}}{7.5\text{m/s}} = 2.0\text{s}$

$Y_f - Y_i = (13.0\text{m/s})t - \frac{1}{2}gt^2 = 6.4\text{m}$