0.1 Homework

5. A train at a constant 60.0 km/h moves east for 40.0 min, then in a direction 50.0° east of due north for 20.0 min, and then west for 50.0 min. What are the (a) magnitude and (b) angle of its average velocity during this trip?

$$= 40\hat{i} + 20cos(40)\hat{i} + 20sin(40)\hat{j} - 50\hat{i}$$
$$= 5.32089\hat{i} + 12.8558\hat{j}$$

21. A dart is thrown horizontally with an initial speed of 10 m/s toward point P, the bull's-eye on a dart board. It hits at point Q on the rim, vertically below P, 0.19 s later. (a) What is the distance PQ? (b) How far away from the dart board is the dart released?

a) Solving for $\hat{i}$ component we get $10 \cdot 0.19 = 1.9m$, then solving for $\hat{j}$ we get

$$\Delta x = \frac{1}{2}at^2 = \frac{1}{2}(-9.8)(0.19)^2 = -0.17689$$

So the distance $\vec{PQ} = |-0.17689| = 0.17689$

b) Then, the distance $\vec{PQ}$ must be $\sqrt{0.17689^2 + 1.9^2} = 1.90822m$

23. A projectile is fired horizontally from a gun that is 45.0 m above flat ground, emerging from the gun with a speed of 250 m/s. (a) How long does the projectile remain in the air? (b) At what horizontal distance from the firing point does it strike the ground? (c) What is the magnitude of the vertical component of its velocity as it strikes the ground?

a)

$$\Delta x = -45 = \frac{1}{2}at^2 = \frac{1}{2}(-9.8)t^2$$
$$t = \pm 3.0305$$

, so the projectile must remain 3.0305 seconds in the air.

b) $3.0305 \cdot 250 = 757.625m$

c) $v = v_0 + at$ and $v_0 = 0, a = 9.8, t = 3.0305$, so $v = -9.8 \cdot 3.0305 = -29.6989m/s$