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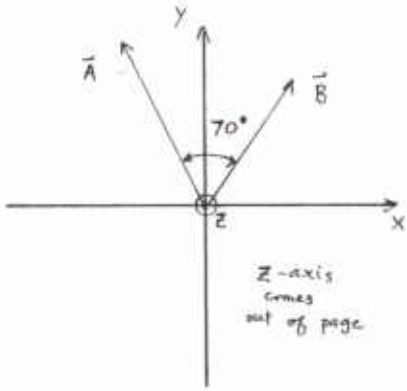
Phys 221 (Section 8)
Quiz #1

1. Express $4.2\frac{\text{in}^2}{\text{s}}$ in units of $\frac{\text{m}^2}{\text{hr}}$

$$4.2\ \tfrac{\text{in}^2}{\text{s}} = \left(4.2\ \tfrac{\text{in}^2}{\text{s}}\right)\left(\frac{1\ \text{ft}}{12\ \text{in}}\right)^2\left(\frac{1\ \text{m}}{3.281\ \text{ft}}\right)^2\left(\frac{3600\ \text{s}}{\text{hr}}\right) = 9.75\ \tfrac{\text{m}^2}{\text{hr}}$$

2. For the vectors sketched in this figure, $|\mathbf{A}| = 6$ and $|\mathbf{B}| = 5$. Both vectors lie in the $x - y$ plane with an angle $\theta = 70°$ between their directions.



a) Find $\mathbf{A} \cdot \mathbf{B}$.

$$\vec{A}\cdot\vec{B} = AB\cos\theta = (6)(5)\cos(70°) = 10.3$$

b) What is the magnitude and direction of $\mathbf{A} \times \mathbf{B}$?

$|\vec{A}\times\vec{B}| = |AB\sin\theta| = (6)(5)\sin 70° = 28.2$

By the right-hand-rule the direction of $\vec{A}\times\vec{B}$ is into the page or along the $-z$ axis.

3. A particle is shot straight up from ground level and attains a maximum height of 70 m.

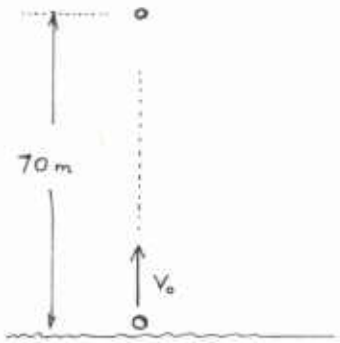
a) What was its initial speed?

Use $v^2 = v_0^2 + 2a(x - x_0)$ with $a = -g$, $x - x_0 = 70$ m

v = final velocity = 0 [At max height, proj. has zero velocity.]

Get: $v_0^2 = v^2 - 2a(x - x_0) = 0 + 2g(x - x_0) = 2(9.8\ \tfrac{\text{m}}{\text{s}^2})(70\ \text{m}) = 1372\ \tfrac{\text{m}^2}{\text{s}^2}$

$\rightarrow v_0 = 37.0\ \tfrac{\text{m}}{\text{s}}$ = initial speed



b) How long did it take to reach maximum height?

Use $v = v_0 + at$ with $v = 0$, $v_0 = 37.0\ \tfrac{\text{m}}{\text{s}}$, $a = -g$

$$0 = 37.0\ \tfrac{\text{m}}{\text{s}} - gt \qquad t = \frac{37.0\ \frac{\text{m}}{\text{s}}}{(9.8\ \frac{\text{m}}{\text{s}^2})} = 3.78\ \text{s}$$

c) What its velocity 4 s after being launched?

Use $v = v_0 + at$ with $v_0 = 37.0\ \tfrac{\text{m}}{\text{s}}$ $a = -g$ $t = 4$ s

and find v:

$$v = (37.0\ \tfrac{\text{m}}{\text{s}}) - (9.8\ \tfrac{\text{m}}{\text{s}^2})(4\ \text{s}) = -2.16\ \tfrac{\text{m}}{\text{s}}$$

The particle has a velocity of $-2.16\ \tfrac{\text{m}}{\text{s}}$ at this time (negative number tells us it is descending at $t = 4.0$ s)

$1\ \text{in} = 2.54\ \text{cm}$ $\quad 1\ \text{m} = 3.281\ \text{ft}$ $\quad g = 9.8\frac{\text{m}}{\text{s}^2}$

$x = x_0 + v_0 t + \frac{1}{2}at^2$ $\quad v = v_0 + at$ $\quad v^2 = v_0^2 + 2a(x - x_0)$ $\quad x = x_0 + \frac{1}{2}(v_0 + v)t$