Projectiles, More Practice

Concepts -

I.) What is the difference between the path of Type 1 and Type 2 projectiles?

II.) Explain why $\vec{v}_{o_y}$ is zero for Type 1 projectiles.

III.) Explain why a_x is zero for all projectiles?

IV.) After drawing the picture what should be the first step in solving a Type 2 projectile?

V.) What formula is used to find time for all projectiles?

VI.) What conditions are necessary to use the horizontal components to find time for a Type 1 projectile?

VII.) What is the relation between $\vec{v}_{o_x}$ and $\vec{v}_{f_x}$, explain why this is.

VIII.) How are $\vec{v}_{f_y}$ and $\vec{v}_{f_x}$ used to find the final velocity of any object?

IX.) When should $v_f^2 = v_o^2 + 2ad$ be used and when should $\vec{v}_f = \vec{v}_o + \vec{a}t$ be used to find the final vertical velocity?

Problems -

1.) A physics student runs at $6.0\frac{m}{s}$ horizontally off a $10.0\ m$ high diving board. What will be her range when landing in the water below?

2.) A rock is tossed off a bridge horizontally at $9.0\frac{m}{s}$ and strikes the ground below $3.2\ s$ later. How high is the bridge and what was the range of the throw?

3.) A rifle is shot horizontally at $300\frac{m}{s}$ from a height of $1.8\ m$. What is the maximum distance the bullet will travel before hitting the ground?

4.) Water sprays horizontally out of a shower head which is $2.12\ m$ above the ground. If the water hits the shower floor $0.85\ m$ from the wall of the shower how fast was the water coming out the showerhead?

5.) A supply plane flying at $250\frac{m}{s}$ releases supplies $3900\ m$ in front of survivors of a shipwreck. How high is the plane?

6.) An Olympic javelin thrower releases the javelin at $30\frac{m}{s}$ at an angle of 40° above the horizontal. What is the range of the projectile?

7.) While skateboarding, a student leaves a jump at $20°$ and velocity $5.0\frac{m}{s}$, what will be the range of his jump?

8.) A football kickoff is moving with an initial velocity of $20\frac{m}{s}$ at $58°$ above the field, what is the range of the kick?

9.) A small electric current zaps a frog causing it to jump at $2.0\frac{m}{s}$ on an angle of $30°$, if the frog was in the middle of a $30\ cm \times 30\ cm$ plate of copper will it get off the copper in one jump?

10.) While studying a kangaroo at a distance a scientist notes the kangaroo consistently jumps on an angle of $35°$. Careful measurements show the range of all jumps to be $4.0\ m$, with what was the velocity the kangaroo leaving the ground?

11.) Calculate velocity when reaching the water of the student in #1.

12.) What is the velocity of the bullet in #3 when it has dropped a vertical distance of $1.0\ m$?

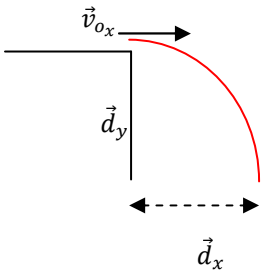
13.) For the football in #8 what is the velocity at the maximum height?

14.) What is the maximum height of the football in #8?

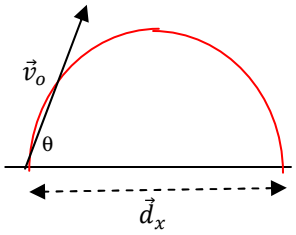
15.) Calculate the velocity of the kangaroo in #10 after $0.30\ s$.

Answers -

I.) Type 1



Type 2



II.) because the projectile is launched horizontally.

III.) zero.

IV.) find $\vec{v}_{o_x}$ and $\vec{v}_{o_y}$.

V.) $\vec{d} = \vec{v}_o t + \frac{1}{2}\vec{a}t^2$.

VI.) must be given $\vec{v}_{o_x}$ and $\vec{d}_x$.

VII.) they are the same because there is no acceleration in the x direction.

VIII.) Pythagoras' theorem.

IX.) use $\vec{v}_f^2 = \vec{v}_o^2 + 2\vec{a}\vec{d}$ when given dy, use $\vec{v}_f = \vec{v}_o + \vec{a}t$ when given time.

1.) $\vec{d}_x = 8.57\ m$

2.) $\vec{d}_y = 50.2\ m$, $\vec{d}_x = 28.8\ m$

3.) $\vec{d}_x = 182\ m$

4.) $1.29\frac{m}{s}$

5.) $\vec{d}_y = 1.19 \times 10^3\ m$

6.) $\vec{d}_x = 90.4\ m$

7.) $\vec{d}_x = 1.64\ m$

8.) $\vec{d}_x = 36.7\ m$

9.) *yes*

10.) $6.46\frac{m}{s}$

11.) $\vec{v}_f = 15.3\frac{m}{s}$

12.) $\vec{v}_f = 300\frac{m}{s}$ *(still)*

13.) $\vec{v}_f = +10.6\frac{m}{s}$

14.) $\vec{d}_y = +14.7\ m$

15.) $5.35\frac{m}{s}$