Projectiles, further practice

Concepts:

I) What is the difference between the path of Type 1 and Type 2 projectiles?
II) Explain why Voy is zero for Type 1 projectiles.
III) Explain why ax 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 v_{ox} and v_{fx}, explain why this is.
VIII) How are v_{fy} and v_{fx} used to find the final velocity of any object?
IX) When should $v_f^2 = v_o^2 + 2ad$ be used and when should $v_f = v_o + at$ be used to find the final vertical velocity?

Problems:

1) A physics student runs at 6.0 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 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 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 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 m/s at an angle of 40^o above the horizontal. What is the range of the projectile?

7) While skateboarding a student leaves a jump at 20^o and velocity 5.0 m/s, what will be the range of his jump?

8) A football kickoff is moving with an initial velocity of 20 m/s at 58^o 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 m/s on an angle of 30^o, if the frog was in the middle of a 30 cm x 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^o. 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?

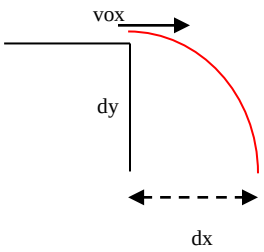
13) For the football in #8 what is the velocity at the maximum height?

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

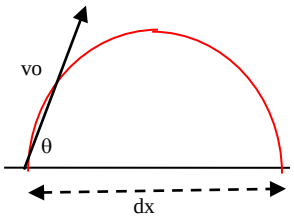
15) Calculate the velocity of the kangaroo in #10 after 0.30 seconds.

Answers

I) type 1



type 2



II) because the projectile is launched horizontally
III) zero
IV) find v_{ox} and v_{oy}
V) $d = v_o t + \frac{1}{2} a t^2$
VI) must be given v_{ox} and dx
VII) they are the same because there is no acceleration in the x direction
VIII) pythagoras' theorem
IX) use $v_f^2 = v_o^2 + 2ad$ when given dy, use $v_f = v_o + at$ when given time

1) dx = 8.57 m	2) dy = 50.2 m, dx = 28.8 m	3) dx = 182 m
4) 1.29 m/s	5) dy = 1.19 x 10^3m	6) dx = 90.4 m
7) dx = 1.64 m	8) dx = 36.7 m	9) yes
10) 6.46 m/s	11) vf = 15.3 m/s	12) vf = 300 m/s (still)
13) vf = 10.6 m/s	14) dy = 14.7 m	15) 5.35 m/s