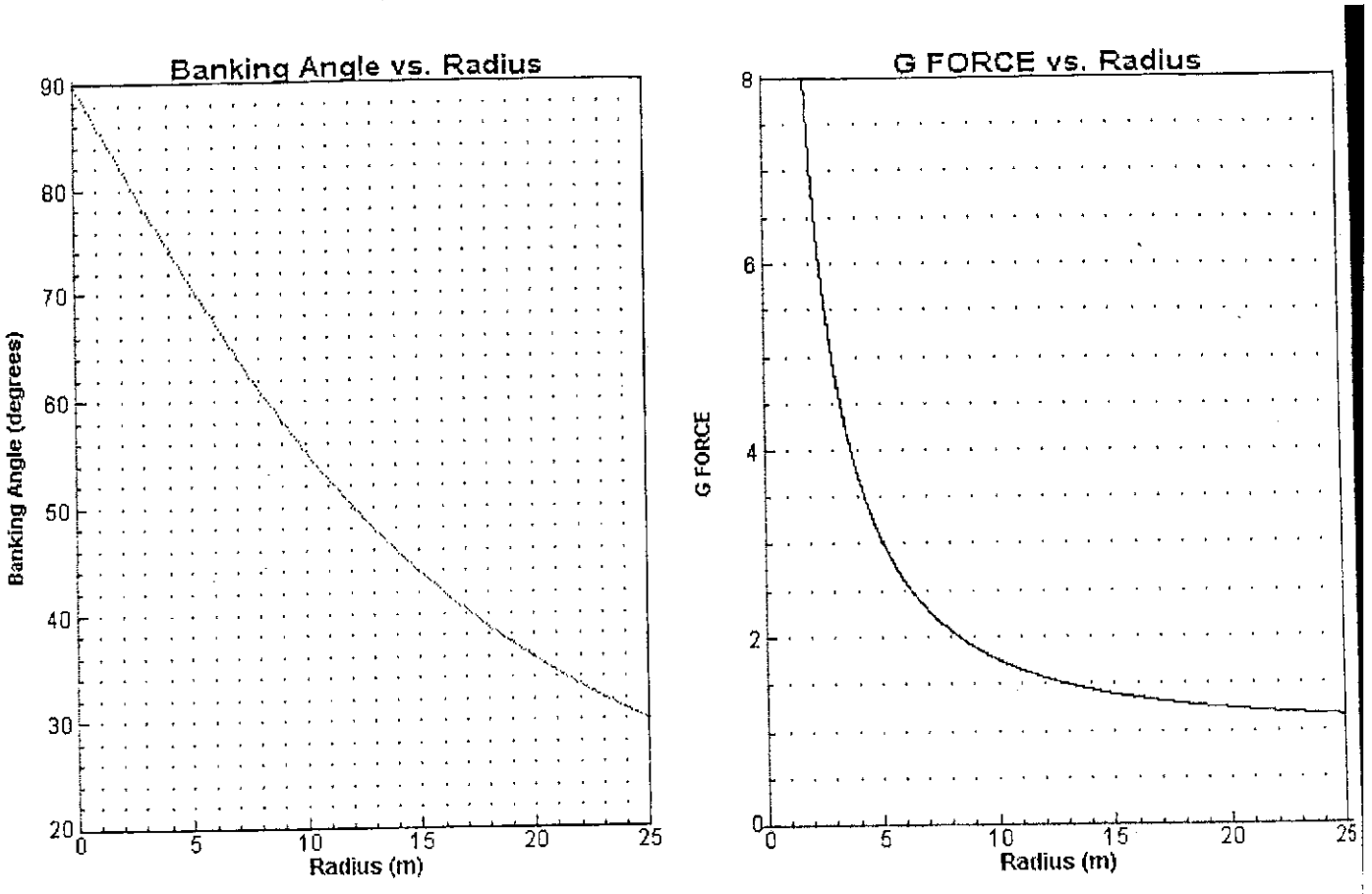
Busch Gardens Pre-Test 3 10 2020

The following data table was taken from the ***Scorpion*** roller coaster at Busch Gardens.

	Trial #1	Trial # 2	Trial #3
Time for the coaster to go around the vertical loop	1.8 seconds	1.7 seconds	2.0 seconds

1. Find the mean time for the vertical loop of the Scorpion.
2. Find the velocity of the coaster around the loop using the mean time and knowing the distance is 35.7 meters.
3. How fast is the coaster traveling in miles per hour?
4. Find the G-force using the velocity from question 2 and given the radius of the vertical loop is 11.4 meters.
5. Find the resultant weight of a 200-pound passenger during the bottom of the loop using the G-force in question 4.
6. The height of the tall hill on the Scorpion measures 24.8 meters tall. Find the predicted velocity of the car at the bottom of the hill.

Use the graphs below to answer questions 7 – 11



7. The radius of the Carrousel is 9 meters. According to the graphs, what should the banking angle be?
8. What is the G-force associated with a radius of 3 meters?
9. If the radius is increased, what happens to the banking angle and the G-force?
10. If the radius is decreased, what happens to the banking angle and the G-force?
11. What banking angle corresponds to a G-force of 3?
12. Using the time in question #1, the velocity found in question #2 (as v_f), and given $v_i = 14.5 \, m/s$, find the acceleration of the coaster during the vertical loop.
13. Using the acceleration in problem #12 and knowing the mass of a loaded cart is 350 kg, find the force (in Newton) of the loaded cart.
14. Using the velocity from question #2 and the mass of the loaded cart in question #13, find the momentum of the loaded cart.
15. Using the force in question #13 and knowing the distance of the loop is 35.7 meters; find the work of the loaded cart.
16. The maximum g-force of the Scorpion is 4.1 and the radius of the track at that point is 22 meters. Find the velocity.

(1) $\frac{1.8s + 1.7s + 2s}{3} = \frac{5.5s}{3} = 1.8s$

(2) $V = \frac{d}{t}$

$V = \frac{35.7m}{1.8s}$

$V = 19.8 \frac{m}{s}$

$V = ?$
$t = 1.8s$
$d = 35.7m$

(3) $(19.8 \frac{m}{s})(2.24) = 44.4 \frac{mi}{hr}$

(4) $G = \frac{V^2}{rg} + 1$

$G = \frac{(19.8 \frac{m}{s})^2}{(11.4m)(9.8 \frac{m}{s^2})} + 1$

$G = \frac{392 \frac{m^2}{s^2}}{111.7 \frac{m^2}{s^2}} + 1$

$G = 3.5 + 1$

$G = 4.5$

$G = ?$
$V = 19.8 \frac{m}{s}$
$r = 11.4m$

(5) $W_R = W G$

$W_R = (200_{lb})(4.5)$

$W_R = 900_{lb}$

$W_R = ?$
$W = 200_{lb}$
$G = 4.5$

(6) $V_p = \sqrt{2gh}$

$V_p = \sqrt{(2)(9.8\frac{m}{s^2})(24.8m)}$

$V_p = \sqrt{486.1\frac{m^2}{s^2}}$

$V_p = 22\frac{m}{s}$

$V_p = ?$
$h = 24.8m$

(tw) (12) $a = \frac{V_f - V_i}{t}$

$a = \frac{19.8\frac{m}{s} - 14.5\frac{m}{s}}{1.8s}$

$a = \frac{5.3\frac{m}{s}}{1.8s}$

$a = 2.9\frac{m}{s^2}$

$a = ?$
$V_f = 19.8\frac{m}{s}$
$V_i = 14.5\frac{m}{s}$
$t = 1.8s$

(13) $F = ma$

$F = (350kg)(2.9\frac{m}{s^2})$

$F = 1015N$

$F = ?$
$a = 2.9\frac{m}{s^2}$
$m = 350kg$

(14) $p = mv$

$p = (350kg)(19.8\frac{m}{s})$

$p = 6930kg\frac{m}{s}$

$p = ?$
$v = 19.8\frac{m}{s}$
$m = 350kg$

(15) $W = Fd$

$W = (1015N)(35.7m)$

$W = 36235.5\,J$

$W = ?$
$F = 1015N$
$d = 35.7m$

(16)

$$G = \frac{v^2}{rg} + 1$$

$$4.1 = \frac{v^2}{(22m)(9.8\frac{m}{s^2})} + 1$$

$$4.1 = \frac{v^2}{215.6\frac{m^2}{s^2}} + 1$$

$-1 \qquad -1$

$$215.6\frac{m^2}{s^2}(3.1) = \left(\frac{v^2}{215.6\frac{m^2}{s^2}}\right)215.6\frac{m^2}{s^2}$$

$$\sqrt{668.4\frac{m^2}{s^2}} = \sqrt{v^2}$$

$$25.9\frac{m}{s} = v$$

$$v = 25.9\frac{m}{s}$$

$G = 4.1$
$r = 22m$
$v = ?$