

1. a. $t^4 + t + \frac{e^{-5t}}{5} + C,$

b. $t^2 + \frac{6}{t} + \frac{\sin(4t)}{4} + C.$

c. $2x - \frac{2}{3}x^{3/2} + 3x^{4/3} + C,$

d. $-e^{-x} - 3 \ln|x| - \frac{x^2}{2} + C$

e. $-x^{-2} - 4x^{1/2} + \frac{e^{4x}}{4} + C,$

f. $\frac{1}{5} \ln|x| + 2 \cos(7x) + 2x^3 + C.$

g. $t^6 + 2t^{-2} - e^{-2t} + C,$

h. $\frac{t^7}{7} + \frac{t^4}{2} + t - \frac{1}{2} \sin(2t) + C.$

2. a. $y(t) = 2t + 0.1e^{-t} + 9.9$

b. $y(t) = 3 - \frac{2}{t}$

c. $y(t) = 1 + 4e^{-2t}$

d. $y(t) = -\frac{\cos(2t)}{2} + t + \frac{5}{2}$

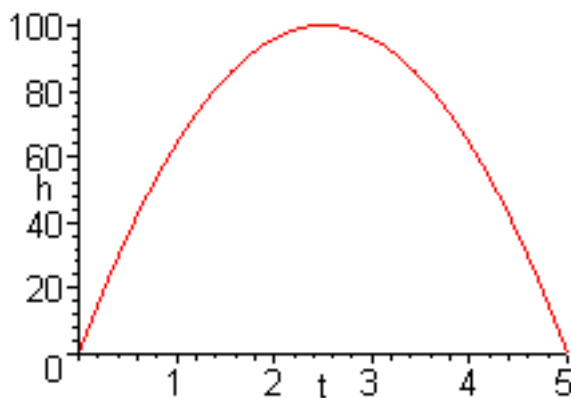
e. $y(t) = 10 + 5e^{-t/2}$

f. $y(t) = \frac{\sin(2t)}{2} + t^2 + 4$

g. $x(t) = 10e^{-(t-1)/3}$

h. $h(t) = 2 \ln(t) + 3$

3. The velocity of the rock is given by $v(t) = 80 - 32t$, while the height of the rock satisfies $h(t) = 80t - 16t^2$. The maximum height occurs at $t = \frac{5}{2}$ sec with the maximum height, $h_{max} = 100$ ft. The ball hits the ground at $t_g = 5$ sec. The graph is below.



4. a. The velocity of the ball is given by $v(t) = 96 - 32t$, while the height of the ball satisfies $h(t) = 256 + 96t - 16t^2$.

b. The ball achieves its maximum height at $t = 3$ sec with $h(3) = 400$ ft. The ball hits the ground when $t = 8$ sec with a velocity of $v(8) = -160$ ft/sec.

5. The antelope remains in the air for 1.225 sec. The initial velocity required to reach 6 ft is $V_0 = 19.6$ ft/sec.

6. a. The velocity of the rock is given by $v(t) = -1.62t$, while the height of the rock satisfies $h(t) = 324 - 0.81t^2$.

b. The rock hits the ground in $t_g = 20$ sec with a velocity of $v_g = -32.4$ m/sec (downward).

7. a. The downward velocity of the cat is $v(t) = 9.8t$ with its distance from the 15th floor given by $s(t) = 4.9t^2$. The time of the fall (without air resistance) is $t_g = 2\sqrt{2} = 2.828$ sec, and the velocity of impact is $v_g = 27.72$ m/sec.

b. With air resistance the downward velocity becomes $v(t) = 28(1 - e^{-0.35t})$. At $t = 3$ sec, $v(3) = 18.2$ m/sec.

c. The position (distance from the 15th floor) is given by $s(t) = 28t + 80e^{-0.35t} - 80$. At $t = 3$ sec, $s(3) = 32.0$ m.

d. To find when $s(t) = 39.2$ m, the appropriate Newton's formula is

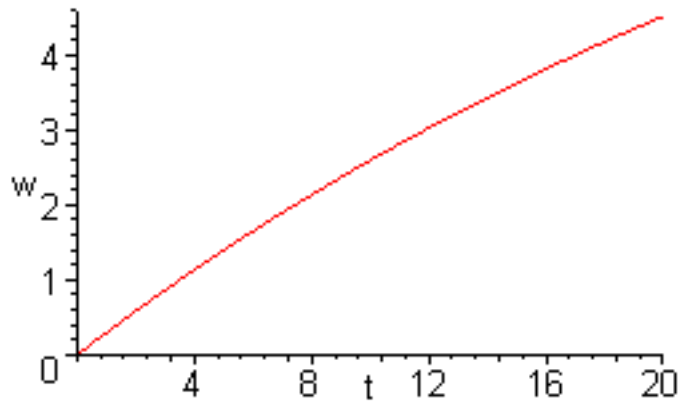
$$t_{n+1} = t_n - \frac{28t_n + 80e^{-0.35t_n} - 119.2}{28 - 28e^{-0.35t_n}}.$$

With $t_0 = 3$, then $t_1 = 3.3958$ sec and $t_2 = 3.3827$ sec. The velocity $v(t_2) = 19.43$ m/sec.

8. a. The weight is given by $w(t) = 10 - 10e^{-0.03t}$. A 2 kg walleye takes 7.4 years. The maximum size is 10 kg. The graph is below.

b. The amount PCBs is $P(t) = 3 \left(t + \frac{100}{3}e^{-0.03t} - \frac{100}{3} \right)$. The PCBs at 2, 5, and 10 years are $P(2) = 0.176$ mg, $P(5) = 1.071$ mg, and $P(10) = 4.082$ mg.

c. The weight and concentration of PCBs at 2, 5, and 10 years are $w(2) = 0.582$ kg, $w(5) = 1.393$ kg, and $w(10) = 2.592$ kg, and $c(2) = 0.303$ $\mu\text{g/g}$, $c(5) = 0.769$ $\mu\text{g/g}$, and $c(10) = 1.575$ $\mu\text{g/g}$



9. a. The weight of a girl is approximated by $w(t) = 65 - 62e^{-0.07t}$. This equation gives weights for ages 2, 4, 7, and 10 of $w(2) = 11.1$ kg, $w(4) = 18.1$ kg, $w(7) = 27.0$ kg, and $w(10) = 34.2$ kg.

b. The amount of Pb in a girl is given by

$$P(t) = -16250e^{-0.4t} + \frac{620000}{47}e^{-0.47t} + \frac{143750}{47}.$$

This equation gives the amount of Pb for ages 2, 4, 7, and 10 of $P(2) = 909.9$ μg , $P(4) = 1790.6$ μg , $P(7) = 2561.8$ μg , and $P(10) = 2880.9$ μg .

c. The concentration of Pb in a girl with this exposure for ages 2, 4, 7, and 10 of $c(2) = 8.20$ $\mu\text{g/dl}$, $c(4) = 9.87$ $\mu\text{g/dl}$, $c(7) = 9.48$ $\mu\text{g/dl}$, and $c(10) = 8.42$ $\mu\text{g/dl}$.