1. $x$-intercepts: $x = -3, 5$, $y$-intercept: $y = 15$, maximum at $(1,16)$. Graph is below to the left.

2. $x$-intercepts: $x = 0, \pm \sqrt{12}$, $y$-intercept: $y = 0$, maximum at $(-2,16)$, minimum at $(2,-16)$, point of inflection at $(0,0)$. Graph is above to the right.

3. $x$-intercepts: $x = 0, \frac{3}{2}$, $y$-intercept: $y = 0$, maximum at $(0,0)$, minimum at $(1,-1)$, point of inflection at $\left(\frac{1}{2}, \frac{-1}{2}\right)$. Graph is below to the left.

4. $x$-intercepts: $x = \pm 1$, $y$-intercept: $y = 1$, maximum at $(0,1)$, minima at $(\pm 1,0)$, points of inflection at $\left(\pm \frac{1}{\sqrt{3}}, \frac{4}{3}\right)$. Graph is above to the right.
5. $x$-intercepts: $x = 0, \sqrt[3]{32}$, $y$-intercept: $y = 0$, minimum at $(2, -48)$, $y'' = 0$ at $x = 0$, but no point of inflection. Graph is below to the left.

6. No $x$ or $y$-intercepts, vertical asymptote at $x = 0$. maximum at $(-1, -4)$, minimum at $(1, 4)$. Graph is above to the right.

7. a. $T'(t) = 0.006 t^2 - 0.18 t + 1.2$. At noon, $T'(12) = -0.096 \, ^\circ$C/hr.

   b. The maximum temperature of the subject occurs at 10 AM with a temperature of 37 °C, while the minimum temperature of the subject occurs at 8 PM ($t = 20$) with a temperature of 36 °C.

8. a. $P'(t) = 3t^2 - 18t + 15$. $P'(2) = -9$ thousand algae/cc/day.

   b. There is a maximum at $t = 1$ with $P(1) = 37$. There is a minimum at $t = 5$ with $P(5) = 5$. The population is increasing for $t \in (0, 1)$ and $t \in (5, 7)$. It is decreasing for $t \in (1, 5)$

   c. The population at the beginning and end are $P(0) = 30$ and $P(7) = 37$. Below is the graph.

9. a. $Y'(t) = t^2 - 12t + 20$. $Y'(6) = -16 \, \mu$l/hr/hr.
b. There is a maximum at \( t = 2 \) with \( Y(2) = \frac{416}{3} \). There is a minimum at \( t = 10 \) with \( Y(10) = \frac{160}{3} \).

c. The \( O_2 \) consumption at the beginning and end are \( Y(0) = 120 \) and \( Y(12) = 72 \). Below is the graph.

10. a. \( T'(t) = 0.01(-135 + 54t - 3t^2) \). \( T'(3) = 0 \).

b. There is a minimum at \( t = 3 \) with \( T(3) = 14.11 \). There is a maximum at \( t = 15 \) with \( T(15) = 22.75 \).

c. The temperature at the beginning and end are \( T(0) = 16 \) and \( T(20) = 17 \). Below is the graph.

11. a. \( v(t) = h'(t) = v_0 - 980t \).

b. \( v(t) = 0 \), when \( t = \frac{v_0}{980} \). The initial velocity to clear the fence is \( v_0 = 420\sqrt{2} \approx 593.97 \) cm/sec.

c. The hang time is \( t = \frac{\frac{v_0}{980}}{\frac{1}{2}} \approx 1.212 \) sec.