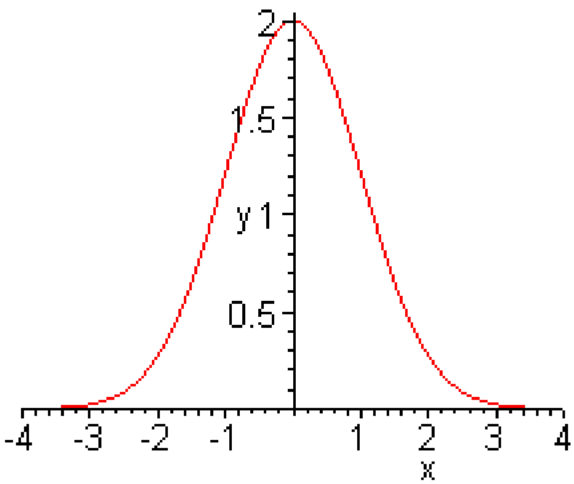
1. $f'(x) = 4(x^2 - 3x + 4)^3(2x - 3)$,

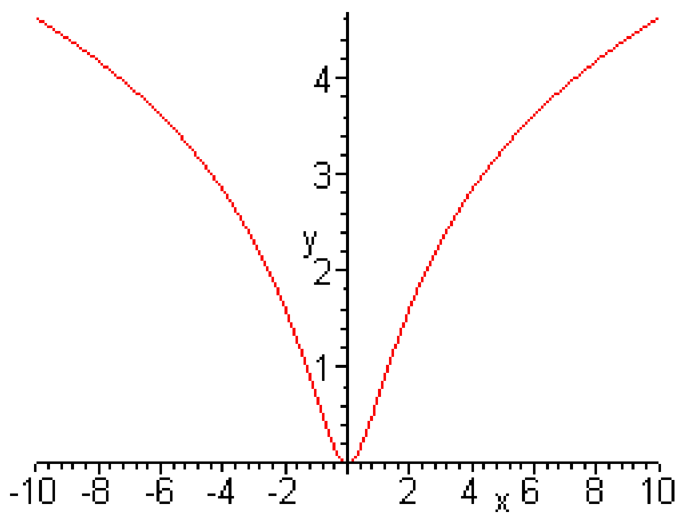
2. $f'(x) = x^2 3(x^3 - 2x + 1)^2(3x^2 - 2) + 2x(x^3 - 2x + 1)^3$,

3. $f'(x) = \dfrac{(2x + 1)2xe^{x^2} - 2e^{x^2}}{(2x + 1)^2} + \dfrac{2}{x}$,

4. $f'(x) = 3(x^2 - e^{-x^2})^2(2x + 2xe^{-x^2})$.

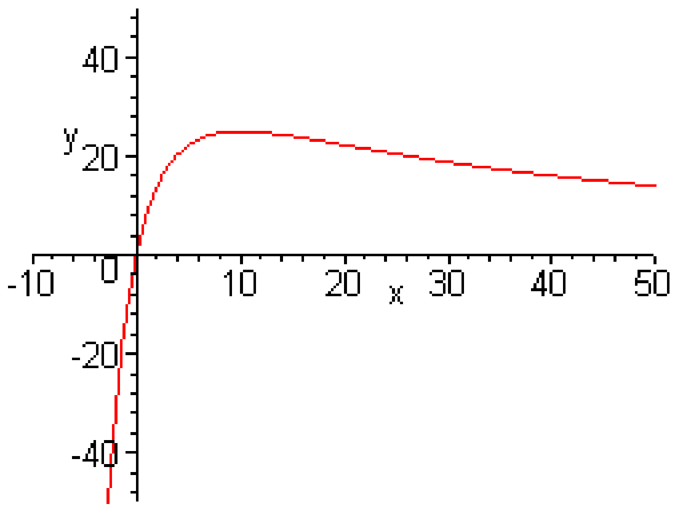
5. $y' = -2xe{-}x^2/2$. Even function. Maximum at $(0, 2)$. Only y-intercept at $(0, 2)$. Horizontal asymptote: $y = 0$. $y'' = 2e{-}x^2/2(x^2 - 1)$. Points of inflection at $(\pm 1, 2e^{-1/2}) \simeq (\pm 1, 1.213)$. Graph is to the left below.

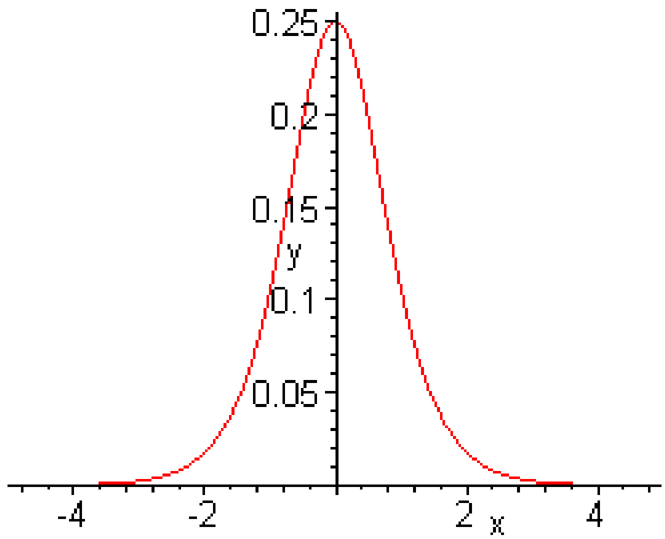




6. $y' = \dfrac{2x}{x^2 + 1}$. Even function. Minimum at $(0, 0)$. Only intercept at $(0, 0)$. No asymptotes. $y'' = \dfrac{2(1 - x^2)}{(x^2 + 1)^2}$. Points of inflection at $(\pm 1, \ln(2)) \simeq (\pm 1, 0.693)$. Graph is to the right above.

7. $y' = \frac{x-10}{(1+0.1x)^3}$. No symmetry. Maximum at $(10, 25)$. Only y-intercept at $(0, 0)$. Horizontal asymptote: $y = 0$. Vertical Asymptote: $x = -10$. $y'' = \frac{-0.2(x-20)}{(1+0.1x)^4}$. Point of inflection at $(20, 22.22)$. Graph is to the left below.





8. $y' = \frac{-2e^{2x}(e^{2x}-1)}{(1+e^{2x})^3}$. Even function. Maximum at $(0, 0.25)$. Only intercept at $(0, 0.25)$. Horizontal asymptote: $y = 0$. $y'' = \frac{4e^{2x}(e^{4x}-4e^{2x}+1)}{(1+e^{2x})^4}$. Points of inflection at $(\pm 0.6585, 0.1667)$. Graph is to the right above.

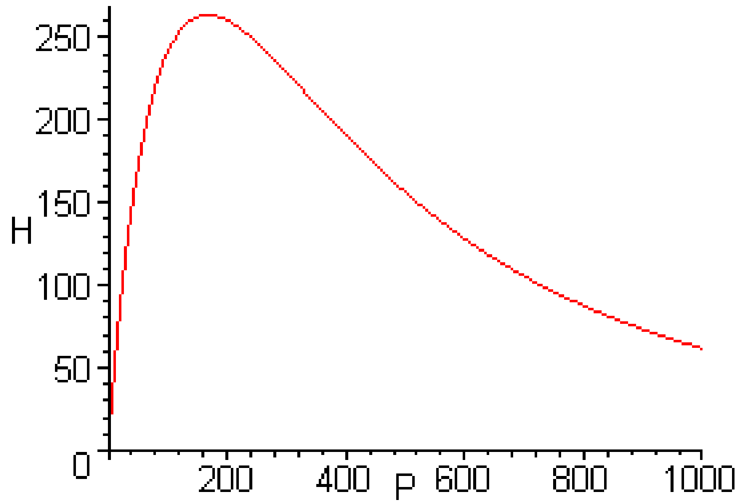
9. a. Rate of growth in height: $h'(a) = 6.44$ cm/yr.

b. Weight as a function of age $W(a) = 0.0000302(6.44a+82.1)^{2.84}$. The derivative is $W'(a) = 0.0005523(6.44a + 82.1)^{1.84}$ kg/yr.

c. Rate of change of weight: $W'(4) = 3.039$ kg/yr, $W'(8) = 4.506$ kg/yr, and $W'(13) = 6.704$ kg/yr.

10. a. The equilibria are $P_e = 0$ and $500(5^{(}1/4) - 1) \simeq 247.67$.

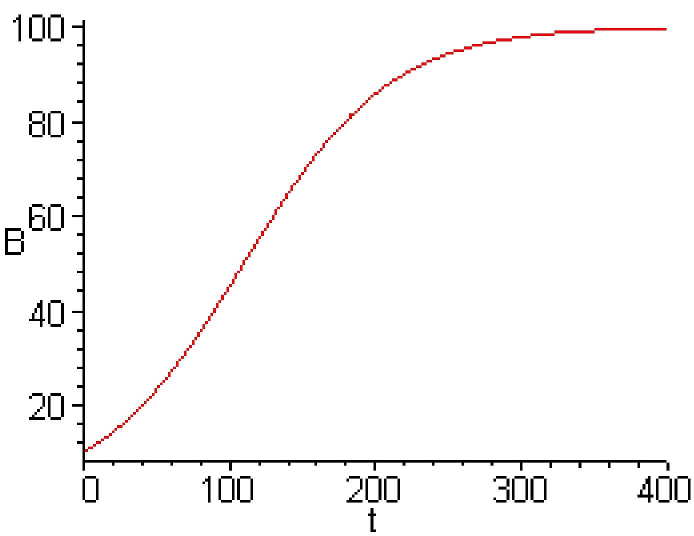
b. Only intercept is $(0, 0)$. Horizontal asymptote: $P_{n+1} = 0$. Maximum at $(500/3, 625(3/4)^3) \simeq (166.7, 263.7)$. A sketch of $H(P)$ is below.

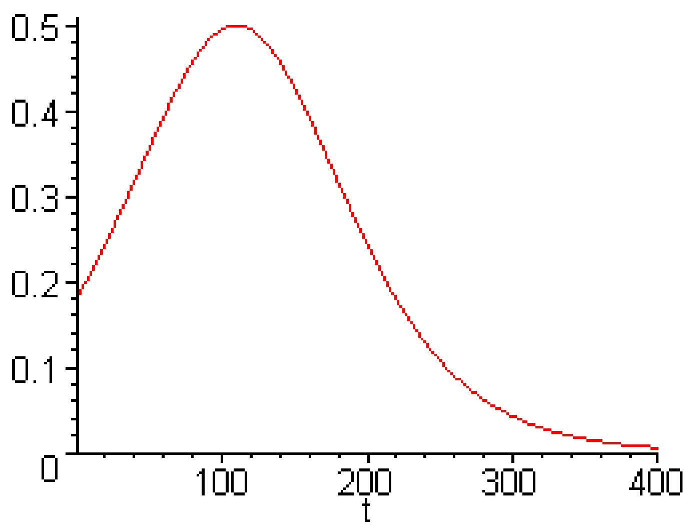


11. a. The derivative of $B(t)$ is $B'(t) = \dfrac{18e^{-0.02t}}{(1 + 9e^{-0.02t})^2}$. The second derivative of $B(t)$ is $B''(t) = \dfrac{0.36(9e^{-0.04t} - e^{-0.02t})}{(1 + 9e^{-0.02t})^3}$.

b. The B-intercept is $(0, 10)$. There is a horizontal asymptote $B = 100$. The point of inflection is $(109.9, 50)$. Below is a sketch of the graph to the left.

c. $B'(0) = 0.18$. There is a horizontal asymptote $B' = 0$. The maximum of the derivative occurs at $(109.9, 0.5)$. Below is a sketch of the graph to the right.



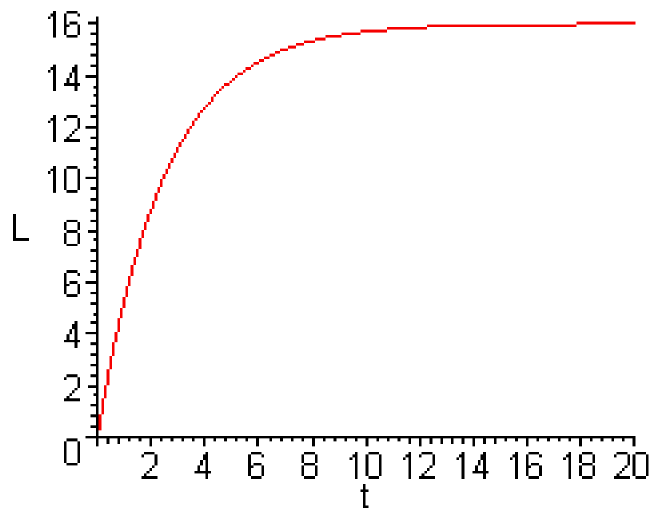


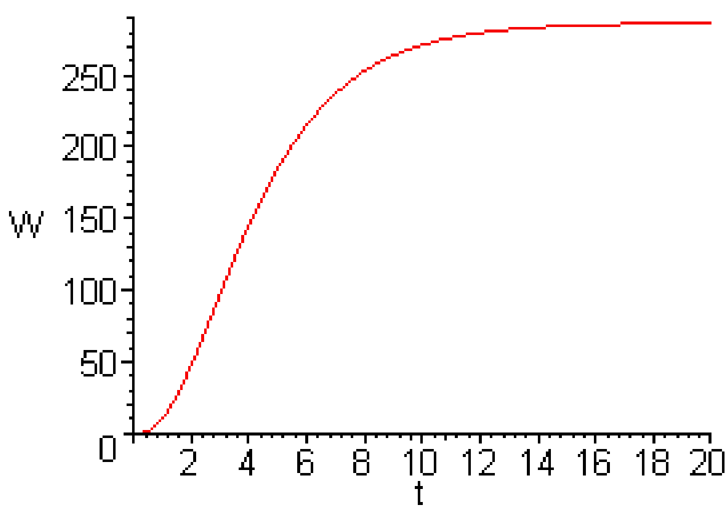
12. The derivative of $W(t)$ is $W'(t) = 15.552e^{-0.2t}(1 - e^{-0.2t})^2$. The second derivative of $W(t)$ is $W''(t) = 3.1104e^{-0.2t}(1 - e^{-0.2t})(3e^{-0.2t} - 1)$. The weight is increasing most rapidly at the point of inflection, which occurs at $t = 5\ln(3) \simeq 5.49$ yrs.

13. a. The intercept is $(0, 0)$, and the horizontal asymptote is $L = 16$ cm. The graph is shown below.

b. The composite function is given by $W(t) = 286.72(1 - e^{-0.4t})^3$. This has an intercept $(0, 0)$, and the horizontal asymptote is $W = 286.72$ g. The graph is shown below.

c. The derivative of $W(t)$ is $W'(t) = 344.064e^{-0.4t}(1 - e^{-0.4t})^2$. The second derivative of $W(t)$ is $W''(t) = 137.6256e^{-0.4t}(1 - e^{-0.4t})(3e^{-0.4t} - 1)$. The weight of the sculpin is increasing most rapidly at the point of inflection, which occurs at $t = \frac{5}{2}\ln(3) \simeq 2.75$ yrs. The average sculpin weighs 84.95 g at this age and is increasing in weight at a rate of 50.97 g/yr.





14. a. The intercept for $P(t)$ is $(0,0)$, while the horizontal asymptote is $P = 20$ metric tons. A graph of this function is below. The derivative is $P'(t) = 4e^{-0.2t}$ metric tons/yr. The rate of change of biomass at $t = 0$ is 4.0 metric tons/yr; at $t = 2$ is 2.68 metric tons/yr; at $t = 10$ is 0.541 metric tons/yr; at $t = 20$ is 0.0733 metric tons/yr.

b. The composite function is given by $H(t) = H(P(t)) = 3\left(1 - e^{-2(1-e^{-0.2t})}\right)$. The derivative satisfies $H'(t) = 1.2e^{-0.2t}e^{-2(1-e^{-0.2t})}$. The rate of change of biomass of the herbivores at $t = 0$ is 1.2 metric tons/yr; at $t = 2$ is 0.416 metric tons/yr; at $t = 10$ is 0.0288 metric tons/yr; at $t = 20$ is 0.003085 metric tons/yr.