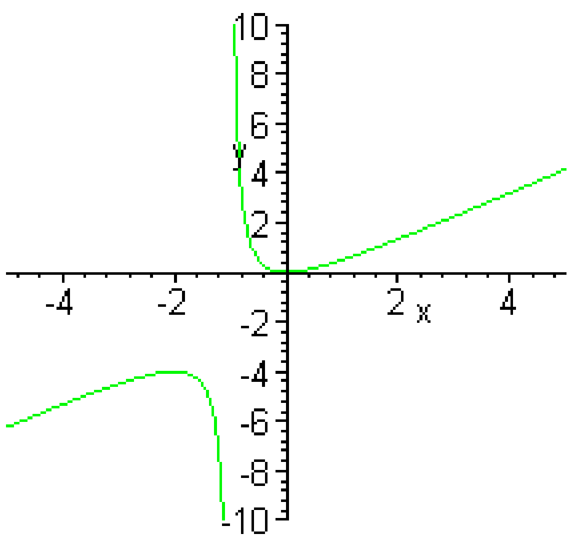
1. $f'(x) = \dfrac{(1-x^2)(3x^2-1/x)+2x(x^3-\ln(x))}{(1-x^2)^2} - 4x^{-3}$,

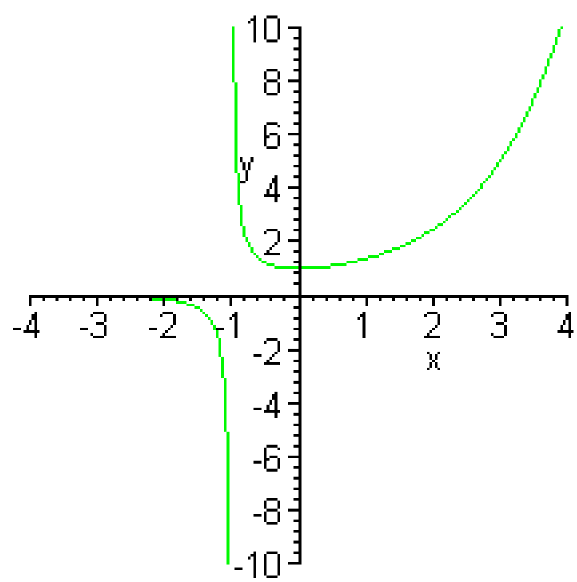
2. $f'(x) = \dfrac{(3x+1)(2x+e^{-x})-3(x^2-e^{-x})}{(3x+1)^2} + (1-x)e^{-x}$,

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

4. $f'(x) = \dfrac{2x(x^2-e^x)-(x^2+5)(2x-e^x)}{(x^2-e^x)^2} - \dfrac{(2x+1)^2e^{2x}-2xe^{2x}}{(2x+1)^2}$.

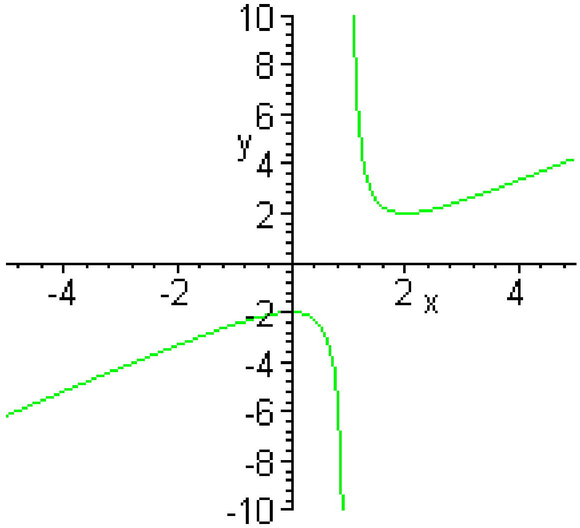
5. $y' = \dfrac{x(x+2)}{(x+1)^2}$. Domain: $x \neq -1$. Maximum at $(-2,-4)$ and minimum at $(0,0)$. Only intercept at $(0,0)$. Vertical asymptote: $x=-1$. Graph is to the left below.

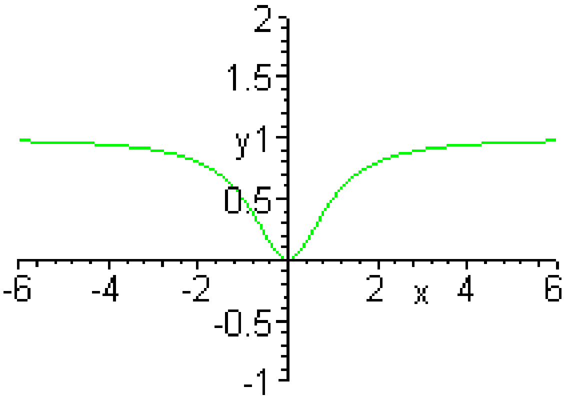




6. $y' = \dfrac{xe^x}{(x+1)^2}$. Domain: $x \neq -1$. Only a y-intercept at $(0,1)$. Vertical asymptote at $x=-1$ and horizontal asymptote at $y=0$ (for $x \to -\infty$). Minimum at $(0,1)$. Graph is to the right above.

7. $y' = \dfrac{x(x-2)}{(x-1)^2}$. Domain: $x \neq 1$. Maximum at $(0,-2)$ and minimum at $(2,2)$. Only a y-intercepts at $(0,-2)$. Vertical asymptote: $x = 1$. Graph is to the left below.



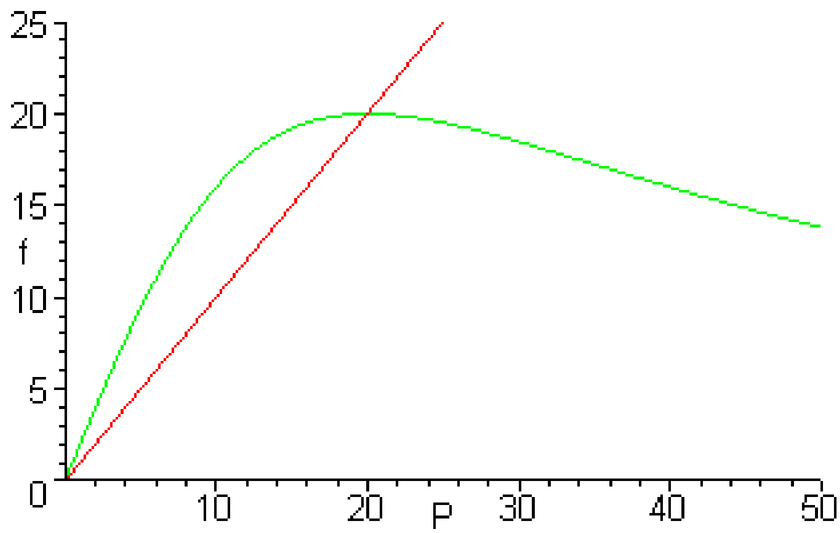


8. $y' = \dfrac{2x}{(x^2+1)^2}$. Domain: All x. Minimum at $(0,0)$. Only intercept is $(0,0)$. Horizontal asymptote: $y = 1$. Graph is to the right above.

9. a. $P_1 = 16$, $P_2 = 19.5$, and $P_3 = 19.99$.

b. A sketch of $f(P)$ and the identity function are below. Only intercept is $(0,0)$. Horizontal asymptote: $P_{n+1} = 0$. Maximum at $(20,20)$.

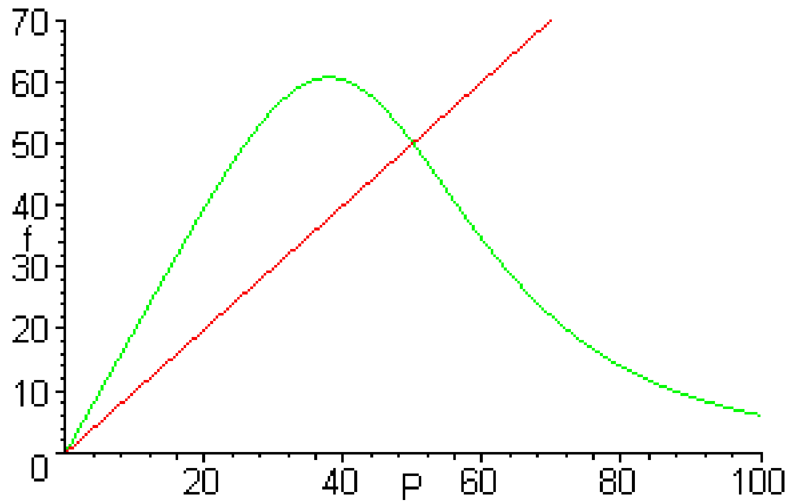
c. The equilibria are $P_e = 0$ and 20. At $P_e = 0$, $f'(0) = 2 > 1$, which means the solution grows monotonically away from the equilibrium, so is unstable. At $P_e = 20$, $f'(20) = 0$, which means the solution monotonically approaches the equilibrium, so is stable.



10. a. $P_1 = 19.99$, $P_2 = 39.58$, and $P_3 = 60.39$.

b. A sketch of $f(P)$ and the identity function are below. Only intercept is $(0, 0)$. Horizontal asymptote: $P_{n+1} = 0$. Maximum at $(50/4^{1/5}, 80/4^{1/5}) \simeq (37.89, 60.63)$.

c. The equilibria are $P_e = 0$ and 50. At $P_e = 0$, $f'(0) = 2 > 1$, which means the solution grows monotonically away from the equilibrium, so is unstable. At $P_e = 50$, $f'(50) = -1.5$, which means the solution oscillates and grows away from the equilibrium, so is unstable.



11. a. $P_1 = 357$, $P_2 = 735$, and $P_3 = 933$.

b. A sketch of $H(P)$ and the identity function are below. Only intercept is $(0, 0)$. Horizontal asymptote: $P_{n+1} = 1250$. No extrema.

c. The equilibria are $P_e = 0$ and 1000. At $P_e = 0$, $H'(0) = 5 > 1$, which means the solution grows monotonically away from the equilibrium, so is unstable. At $P_e = 1000$, $H'(1000) = 0.2$, which means the solution monotonically approaches the equilibrium, so is stable.