Find the derivatives of the following functions.
Remember that you can verify your answers by graphing.

1. $f(x) = \ln(x^2 - x)$

$$f'(x) = \frac{1}{x^2 - x} \cdot (2x - 1).$$

2. $f(x) = e^x \tan(x)$

$$f'(x) = e^x \sec^2(x) + e^x \tan(x).$$

3. $f(x) = \dfrac{\sec(x) + x^2}{\ln(x)}$

$$f'(x) = \frac{\ln(x)(\sec(x)\tan(x) + 2x) - (\sec(x) + x^2)\left(\dfrac{1}{x}\right)}{(\ln(x))^2}$$

4. $f(x) = (3x^2 - 7)\sin(x)$

$$f'(x) = (3x^2 - 7)\cos(x) + (6x)\sin(x)$$

5. $f(x) = (\cot(x))^5 + 7$

$$f'(x) = -5\cot^4(x)\csc^2(x)$$

6. $f(x) = \csc(x^4)$

$$f'(x) = -4x^3 \csc(x^4)\cot(x^4)$$

7. $f(x) = 3^{2x\tan(x)}$

$$f'(x) = \ln(3)3^{2x\tan(x)}(2x\sec^2 x + 2\tan(x))$$

8. $f(x) = \dfrac{\sec(x^2)}{e^x}$

$$f'(x) = \frac{2xe^x\sec(x^2)\tan(x^2) - e^x\sec(x^2)}{e^{2x}}$$

9. $f(x) = x^5e^x\sin(x^3)$

$$f'(x) = x^5e^x\cos(x^3)3x^2 + x^5e^x\sin(x^3) + 5x^4e^x\sin(x^3)$$

10. $f(x) = \sqrt{x^2\cos(x)}$

$$f'(x) = \frac{-x^2\sin(x) + 2x\cos(x)}{2\sqrt{x^2\cos(x)}}$$

11. $f(x) = \cos(\sin(x^5))$

$$f'(x) = -5x^4\sin(\sin(x^5))\cos(x^5)$$

12. $f(x) = \left(\dfrac{x^2}{\ln(x)}\right)^3$

$$f'(x) = \frac{3x^4(2x\ln(x) - x)}{(\ln(x))^4}$$

13. $f(x) = \log_4\left(e^{5x^2}\cos(e^x)\right) + \cot(e)$

$$f'(x) = \frac{-e^{5x^2+x}\sin(e^x) + 10xe^{5x^2}\cos(e^x)}{\ln(4)e^{5x^2}\cos(e^x)}$$

14. $f(x) = \dfrac{x^{42} + 3\cos(4x^3+\pi)}{e^{2x^2} - \sqrt{x}}$

$$\begin{aligned} f'(x) &= \frac{(e^{2x^2} - \sqrt{x})(42x^{41} + -3\sin(4x^3+\pi)\cdot 12x^2)}{(e^{2x^2} - \sqrt{x})^2} \\ &\quad - \frac{(x^{42} + 3\cos(4x^3+\pi))(e^{2x^2}\cdot 4x - \frac{1}{2}x^{-1/2})}{(e^{2x^2} - \sqrt{x})^2} \end{aligned}$$