1. (a) 

(b) Formula: 

\[(g \circ f)(x) = \sqrt{2^x - 1}\]. Domain: \(\{2^x - 1 \geq 0\}\), which is \(\{x \geq 0\} = [0, \infty)\).

2. \(F'(r) = 3r^2 + e^r\)

3. (a) 

\[
\lim_{x \to -4} \frac{\frac{1}{4} + \frac{1}{x}}{4 + x} = \lim_{x \to -4} \frac{x + 4}{4x(4 + x)} = \lim_{x \to -4} \frac{1}{4x} = -\frac{1}{16}
\]

(b) 

\[
\lim_{x \to \infty} \frac{x + 2}{\sqrt{9x^2 + 1}} = \lim_{x \to \infty} \frac{x + 2}{\sqrt{9x^2 + 1}} \frac{1}{\sqrt{x^2}} = \lim_{x \to \infty} \frac{1 + \frac{2}{x}}{\sqrt{9 + \frac{1}{x^2}}} = \frac{1 + 0}{\sqrt{9 + 0}} = \frac{1}{3}
\]

4. 

5. 

\[
f'(x) = \lim_{h \to 0} \frac{((x + h)^2 + 2) - (x^2 + 2)}{h} = \lim_{h \to 0} \frac{x^2 + 2xh + h^2 + 2 - x^2 - 2}{h}
\]

\[
= \lim_{h \to 0} \frac{2xh + h^2}{h} = \lim_{h \to 0} 2x + h = 2x + 0 = 2x
\]

6. The denominator of this fraction is \(x^2 - x = x(x - 1)\), so it has zeros at \(x = 0\) and at \(x = 1\). These numbers are not zeros of the numerator. Therefore \(x = 0, x = 1\) are both
vertical lines which are vertical asymptotes of the graph. For the horizontal asymptote we compute
\[
\lim_{x \to \pm\infty} \frac{x^3 + 8}{x^2 - x} = \pm\infty.
\]
Thus there is no horizontal asymptote.

7. (a) 
\[
v_{\text{aver}} = \frac{y(2) - y(1)}{2 - 1} = \frac{(20 - 1.86(2)^2) - (10 - 1.86(1)^2)}{1} = 10 - 1.86(3) = 4.42 \text{ m/s}
\]
(b) 
\[
v_{\text{inst}} = \lim_{t \to 1} \frac{(10t - 1.86t^2) - (10 - 1.86(1)^2)}{t - 1} = \lim_{t \to 1} \frac{10(t - 1) - 1.86(t^2 - 1)}{t - 1}
\]
\[
= \lim_{t \to 1} 10 - 1.86(t + 1) = 10 - 1.86(2) = 6.28 \text{ m/s}.
\]
(c) 
\[
\frac{dy}{dt} = 10 - 2(1.86)t = 10 - 3.72t.
\]
(And note that \((dy/dt)|_{t=1} = 6.28\).)

8. The statement means that the values of \(f(x)\) can be made as close as desired to \(L\) by choosing \(x\) sufficiently close to, but not equal to, \(a\).

9. (a) \(f(x) = \cos 5x\) is continuous at \(x = 0\) because \(x = 0\) is in the domain of \(f\) and \(\lim_{x \to 0} \cos 5x = 1 = \cos(5 \cdot 0)\)
(b) 
\[
\lim_{x \to 0} \left( x^3 + \frac{\cos 5x}{10000} \right) = 0^3 + \frac{1}{10000} = 0.0001
\]
because the function in parentheses is continuous.

10. Input \(x = 10/7\) produces output \(y = 7/10 = 0.7\) and input \(x = 10/3\) produces output \(y = 3/10 = 0.3\). The distance from \(10/7\) to 2 is \(2 - (10/7) = 4/7\) while the distance from \(10/3\) to 2 is \((10/3) - 2 = 4/3\). And
\[
\frac{4}{3} > \frac{4}{7},
\]
a fact suggested by the picture as well. Therefore you can choose \(\delta = 4/7\); you don’t need to know that \(4/7 = 0.57142857\ldots\). In other words, the picture shows
\[
\text{if } |x - 2| < \frac{4}{7} \text{ then } \left| \frac{1}{x} - 0.5 \right| < 0.2.
\]

Extra credit. The polynomial \(p(x) = x^4 + x - 3\) is continuous on the whole real line so we can use the intermediate value theorem (IVT) on any interval. I plugged in some values, starting with \(x = 0\). Note \(p(0) = -3\) is negative, but the function goes to \(+\infty\) as \(x \to \pm\infty\). Also I notice that \(p(-2) = +9\) and \(p(2) = +15\). Therefore, using the IVT on the interval \([-2,0]\) with \(L = 0\) we conclude there is a solution between \(-2\) and 0. By the same argument there is another solution on the interval \([0,2]\).