1. \[
\frac{x + 3}{x^2 + 4x + 3} = \frac{x + 3}{(x + 3)(x + 1)} = \frac{1}{x + 1} \to \frac{1}{-3 + 1} = -\frac{1}{2} \text{ as } x \to -3
\]

2. By long division

\[
v^2 \quad +2v \quad +4
\]

\[
v^3 \quad -2v^2
\]

\[
2v^2 \quad -4v
\]

\[
4v \quad -8
\]

\[
4v \quad -8
\]

\[
0
\]

\[
\frac{v^3 - 8}{v - 2} = v^2 + 2v + 4 \text{ so } v^3 - 8 = (v - 2)(v^2 + 2v + 4).
\]

\[
\frac{v^3 - 8}{v^4 - 16} = \frac{(v - 2)(v^2 + 2v + 4)}{(v^2 - 4)(v^2 + 4)} = \frac{(v - 2)(v^2 + 2v + 4)}{(v - 2)(v + 2)(v^2 + 4)}
\]

\[
= \frac{(v^2 + 2v + 4)}{(v + 2)(v^2 + 4)} \to \frac{12}{4 \cdot 8} = \frac{3}{8} \text{ as } x \to 2.
\]

3. As \(x \to 0^-, x^{5/3}\) is small, negative. \(\therefore \frac{1}{x^{5/3}} \to -\infty \text{ as } x \to 0^-\)
4. \( \sqrt{x_1 - 7} = 3, \quad x_1 - 7 = 9, \quad x_1 = 16. \)
\( \sqrt{x_2 - 7} = 5, \quad x_2 - 7 = 25, \quad x_2 = 32. \)
If the distance between \( x \) and 23 is less than 9 and if \( x \) is to the right of 23 then \( |f(x) - L| < 1. \)
If the distance between \( x \) and 23 is less than 7 and if \( x \) is to the left of 23 then \( |f(x) - L| < 1. \)
We need to choose \( \delta \) so that if \( |x - 23| < \delta \) then \( |f(x) - L| < 1. \) Since \( x \) can be to the right or left of 23, we need to choose the smaller of the two numbers 7 and 9. \( \therefore \) Let \( \delta = 7. \)

5. \( f(x) = x^5 + x - 3, \quad f(0) = -3, \quad f(2) = 31. \) \( \therefore \) there exists \( c \) between 0 and 2 with \( f(c) = 0 \) by the Intermediate Value Property, since 0 is between -3 and 31.

6. \[
\frac{f(x+h) - f(x)}{h} = \frac{\sqrt{x+h+1} - \sqrt{x+1}}{h} = \frac{(\sqrt{x+h+1} - \sqrt{x+1}) \cdot (\sqrt{x+h+1} + \sqrt{x+1})}{h \cdot (\sqrt{x+h+1} + \sqrt{x+1})}
\]
\[
= \frac{x + h + 1 - (x + 1)}{h(\sqrt{x+h+1} + \sqrt{x+1})} = \frac{1}{\sqrt{x+h+1} + \sqrt{x+1}} \rightarrow \frac{1}{2\sqrt{x+1}} \text{ as } h \to 0
\]
So at \( x = 9, \quad m = \frac{1}{2\sqrt{10}} = \frac{\sqrt{10}}{20}. \)
7. \( \frac{d}{dx} \left( \frac{x^2 - 1}{x^2 + 1} \right) = \frac{(x^2 + 1)2x - (x^2 - 1)(2x)}{(x^2 + 1)^2} = \frac{2x((x^2 + 1) - (x^2 - 1))}{(x^2 + 1)^2} = \frac{4x}{(x^2 + 1)^2} \)

8. \( y = x^2 + x^{-2}, \quad y' = 2x - 2x^{-3}, \quad y'' = 2 + 6x^{-4}. \)

9. \( y = \frac{(x^2 + x)(x^2 - x + 1)}{x^4} = \frac{x^4 - x^3 + x^3 - x^2 + x}{x^4} = \frac{x^4 + x}{x^4} = 1 + x^{-3} \)
   \( y' = -3x^{-4}, \quad y'' = 12x^{-5}. \)

10. \( s = -16t^2 + 160t, \quad v = \frac{ds}{dt} = -32t + 160 = 0 \text{ when } t = \frac{160}{32} = 5. \) At that time \( s = -16 \cdot 5^2 + 160 \cdot 5 = 400. \)