1. Let 
\[ f(x) = e^{\frac{x^3-2}{x+1}} \]
Find \( f'(x) \) by using any combination of the product rule, quotient rule or chain rule you like.

2. Let 
\[ g(x) = \sqrt{2x^3 - 3x^2 - 12x + 5} \]
Find all points \( x_0 \) such that \( g'(x_0) = 0 \).

**Solutions:**

1. The primary rule to be applied here is the chain rule. Let \( a(x) = e^x \) and \( b(x) = \frac{x^3-2}{x+1} \). Then
\[ a(b(x)) = a\left(\frac{x^3-2}{x+1}\right) = e^{\frac{x^3-2}{x+1}}, \]
so all we’ve done is rewritten \( f(x) \) as \( f(x) = a(b(x)) \). Then the formula for the chain rule tells us \( f'(x) = a'(b(x))b'(x) \). We know \( a'(x) = e^x \), and then by the quotient rule we have
\[ b'(x) = \frac{3x^2(x+1) - (x^3-2)(1)}{(x+1)^2} \]
\[ = \frac{2x^3 + 3x^2 + 2}{(x+1)^2} \]
Therefore
\[ f'(x) = a'(b(x))b'(x) \]
\[ = a'\left(\frac{x^3-2}{x+1}\right) \frac{2x^3 + 3x^2 + 2}{(x+1)^2} \]
\[ = e^{\frac{x^3-2}{x+1}} \left(\frac{2x^3 + 3x^2 + 2}{(x+1)^2}\right) \]
2. To solve \( g'(x) = 0 \) we first need to know \( g'(x) \). Again we apply the chain rule. Let 
\[ a(x) = \sqrt{x} = x^{1/2}, \] 
and 
\[ b(x) = 2x^3 - 3x^2 - 12x + 5. \] 
Then \( g(x) = a(b(x)) \), so by the chain rule we know 
\[ g'(x) = a'(b(x))b'(x). \] 
We have
\[
a'(x) = \frac{d}{dx} x^{1/2} = \frac{1}{2} x^{-1/2}
\]
and 
\[
b'(x) = \frac{d}{dx} (2x^3 - 3x^2 - 12x + 5) = 6x^2 - 6x - 12 = 6(x^2 - x - 2)
\]
Therefore
\[
g'(x) = a'(b(x))b'(x)
\]
\[
= a'(2x^3 - 3x^2 - 12x + 5)b'(x)
\]
\[
= \frac{1}{2} (2x^3 - 3x^2 - 12x + 5)^{-1/2} \cdot 6(x^2 - x - 2)
\]
\[
= \frac{3(x^2 - x - 2)}{(2x^3 - 3x^2 - 12x + 5)^{1/2}}
\]
Since \( g'(x) \) is a fraction it can only be zero if the numerator is zero, i.e. \( g'(x) = 0 \) only if \( x^2 - x - 2 = 0 \). By factoring we get
\[
x^2 - x - 2 = (x - 2)(x + 1) = 0
\]
which means \( x = 2 \) or \( x = -1 \). Thus the points \( x_0 \) such that \( g'(x_0) = 0 \) are \( x_0 = 2 \) and \( x_0 = -1 \). These points are called the critical points of \( g \). They are of special interest because they are points at which \( g \) possibly (but not necessarily) achieves its maximum/minimum values.