**Question:** Can we use the original formula?

Earlier, we found that:

\[ f(x) = \frac{e^{-3x}}{\sqrt{1 + x}} \approx 1 - \frac{7}{2}x. \]

Could we use a different method to get a linear approximation of the function \( f(x) \)?

Yes. We could calculate \( f' \) and use the formula for linear approximation to find:

\[ f(x) \approx f(0) + f'(0)x. \]

This must also be a linear approximation to \( \frac{e^{-3x}}{\sqrt{1 + x}} \).

We can easily find that \( f(0) = 1 \). Computing \( f'(x) \) by the product rule is an annoying, somewhat long computation. Because of what we’ve just done we know that \( f'(0) \) must equal \(-\frac{7}{2}\). We used linear approximation as a shortcut to avoid computing \( f'(0) \) directly.

When we study quadratic approximation we’ll quickly see that combining approximations for complicated functions is far superior to differentiating them twice.

**Question:** If we find the linear approximation by differentiating, do we have to throw away an \( x^2 \) term?

**Answer:** No. But remember that when \( x \) is close to 0 throwing away an \( x^2 \) term has very little influence on our final value. Throwing away the \( x^2 \) was an easy way to simplify our expression; it’s not something we should be trying to avoid here. (Linear approximation just captures the linear features of the function; we are not concerning ourselves with higher order terms here.)