This test has pages 1 through 5 – take a moment to check that you have them all.

Show work and answers.

No calculators.

1  Find the first derivatives by fast rules. Simplify.

(a)  \( F(x) = 2x^3 - 3x^2 - 7 \)

(b)  \( f(x) = \frac{8x}{x^2 + 4} \)

(c)  \( g(x) = e^{-3x} \)

(d)  \( h(x) = \ln(4x) \)
2. Find the first derivatives by *fast* rules. Simplify.

(a) \( k(x) = e^{x^2 + 4} \)

(b) \( f(x) = \ln(x^2 + 4) \)

(c) \( L(x) = x^4 \ln(x) \)

(d) \( r(x) = xe^{-3x} \)
3 Here we have the graph of $f(x) = x^3 - 3x^2 + 4$ (the vertical scale is unknown)

Compute an exact equation for the dashed line on the graph.

4 Suppose that $f$ is a function for which we know that

$$f'(x) = 5x(x - 3)(x + 1)$$

Make the best rough graph of $f$ you can manage from this $f'$ information.
Match the following graphs with the equations below by writing the appropriate plot number in the blank next to the appropriate equation:

Plot #1

Plot #2

Plot #3

Plot #4

Plot #5

Plot #6

\[ f(x) = 2.5 - e^{-3/4x} \]

\[ f(x) = x^3 \]

\[ f(x) = \frac{x}{x - 1} \]

\[ f(x) = e^{-x} \]

\[ f(x) = \ln(x) \]

\[ f(x) = e^x \]
6 A farmer wants a 200-square-foot rectangular enclosure next to a barn. This means that he doesn’t need to fence of the side against the barn. Use calculus to determine the dimensions of the enclosure which requires the least fencing. What is this minimal amount of fencing?