

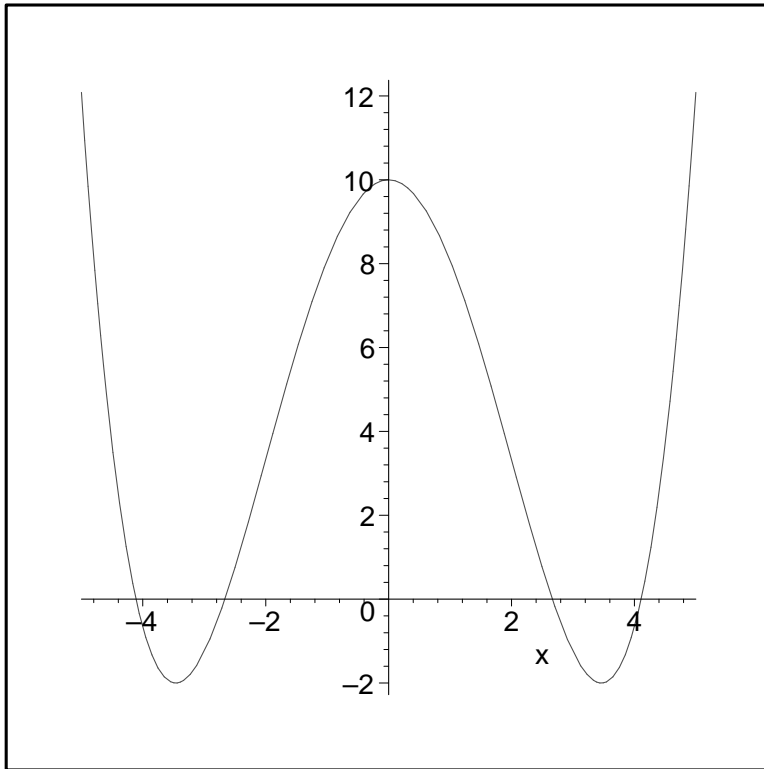
Practice Exam 2

You should work through this as you would an actual exam. Time yourself, and try to solve each problem alone without using your notes or your book.

- The time S at which sunrise occurs on the first day of the month (in hours after midnight) is given as a function of the number of months t since January 1 in the table below. Approximate $S'(2)$. Give units and interpret your answer.

0	7.76
1	7.6
2	7.001
3	6.37
4	5.72
5	5.33
6	5.37
7	5.7
8	6.1
9	6.5
10	6.95
11	7.45

- Approximate the slope to the tangent line of $y = e^{\cos x}$ at $x = \frac{\pi}{2}$, and use your approximation to find an equation for the tangent line.
- Differentiate $f(x) = \sqrt{5x+1} + x^2$ using the definition of the derivative.
- Show that $f(x) = |x|$ is differentiable on $(-\infty, 0) \cup (0, \infty)$ but not at 0.
- Graph a possible antiderivative $F(x)$ of the function $f(x)$ pictured below. Tell where $F(x)$ is increasing, decreasing, concave up, and concave down.



6. Find

$$\frac{d}{dx} \frac{\sqrt{x} \sqrt[3]{x}}{x^4}$$

7. If the total percentage of proteins in a bowl of egg whites that has been denatured after t minutes of whipping is given by $E(t) = \frac{100e^t}{e^t + 99}$, determine how quickly the proteins are breaking down after 3 minutes.

8. Suppose at time $t = 0$ a particle P located at $(15, 30)$ in the (x, y) plane is moving straight downward with horizontal acceleration $-30m/s^2$ and vertical acceleration $55m/s^2$. If the rectangle with opposite vertices at P and the origin is shrinking at a rate of $75m^2/s$, determine whether the shrinkage of the rectangle is speeding up or slowing down.

9. Find

$$\frac{d^2}{dx^2} \tan x$$

10. Find

$$\frac{d}{dq} [q^e + e^q + eq + qe + q + e]$$

11. Use the definition of the derivative to find

$$\frac{d}{dx} \frac{x^4 - 5x^2 + 2}{x + 1}$$

Check your answer using the quotient rule.