

**Calculus Practice: Use Derivatives to Analyze Functions 8b****For each problem, find the open intervals where the function is concave up and concave down.**

1)  $y = -x^5 + 3x^3 - 2$

2)  $y = x^3 + 11x^2 + 35x + 27$

3)  $y = -2x^2 + 1$

4)  $f(x) = x^3 - 4x^2 + 2$

5)  $y = x^3 - 2x^2 + 3$

6)  $f(x) = x^4 + x^3 - 3x^2 - 2$

7)  $f(x) = x^4 - x^3 - x^2 - 1$

8)  $y = -x^2 - 4x - 3$

$$9) y = -\frac{x^2}{2} + 2x + 4$$

$$10) f(x) = x^4 + x^3 - 2x^2 - 3$$

$$11) f(x) = -x^3 + x^2 + 2$$

$$12) y = x^3 - 4x^2 + 3$$

$$13) f(x) = x^5 - 2x^3 - 1$$

$$14) f(x) = x^4 - 3x^2$$

$$15) y = x^5 - 3x^3 - 1$$

$$16) y = x^3 - 2x^2 - 2$$

**Calculus Practice: Use Derivatives to Analyze Functions 8b****For each problem, find the open intervals where the function is concave up and concave down.**

1)  $y = -x^5 + 3x^3 - 2$

Concave up:  $\left(-\infty, -\frac{3\sqrt{10}}{10}\right), \left(0, \frac{3\sqrt{10}}{10}\right)$  Concave down:  $\left(-\frac{3\sqrt{10}}{10}, 0\right), \left(\frac{3\sqrt{10}}{10}, \infty\right)$

2)  $y = x^3 + 11x^2 + 35x + 27$

Concave up:  $\left(-\frac{11}{3}, \infty\right)$  Concave down:  $\left(-\infty, -\frac{11}{3}\right)$

3)  $y = -2x^2 + 1$

Concave up: No intervals exist. Concave down:  $(-\infty, \infty)$

4)  $f(x) = x^3 - 4x^2 + 2$

Concave up:  $\left(\frac{4}{3}, \infty\right)$  Concave down:  $\left(-\infty, \frac{4}{3}\right)$

5)  $y = x^3 - 2x^2 + 3$

Concave up:  $\left(\frac{2}{3}, \infty\right)$  Concave down:  $\left(-\infty, \frac{2}{3}\right)$

6)  $f(x) = x^4 + x^3 - 3x^2 - 2$

Concave up:  $(-\infty, -1), \left(\frac{1}{2}, \infty\right)$  Concave down:  $\left(-1, \frac{1}{2}\right)$

7)  $f(x) = x^4 - x^3 - x^2 - 1$

Concave up:  $\left(-\infty, \frac{3 - \sqrt{33}}{12}\right), \left(\frac{3 + \sqrt{33}}{12}, \infty\right)$  Concave down:  $\left(\frac{3 - \sqrt{33}}{12}, \frac{3 + \sqrt{33}}{12}\right)$

8)  $y = -x^2 - 4x - 3$

Concave up: No intervals exist. Concave down:  $(-\infty, \infty)$

$$9) y = -\frac{x^2}{2} + 2x + 4$$

Concave up: No intervals exist. Concave down:  $(-\infty, \infty)$

$$10) f(x) = x^4 + x^3 - 2x^2 - 3$$

Concave up:  $\left(-\infty, \frac{-3 - \sqrt{57}}{12}\right), \left(\frac{-3 + \sqrt{57}}{12}, \infty\right)$  Concave down:  $\left(\frac{-3 - \sqrt{57}}{12}, \frac{-3 + \sqrt{57}}{12}\right)$

$$11) f(x) = -x^3 + x^2 + 2$$

Concave up:  $\left(-\infty, \frac{1}{3}\right)$  Concave down:  $\left(\frac{1}{3}, \infty\right)$

$$12) y = x^3 - 4x^2 + 3$$

Concave up:  $\left(\frac{4}{3}, \infty\right)$  Concave down:  $\left(-\infty, \frac{4}{3}\right)$

$$13) f(x) = x^5 - 2x^3 - 1$$

Concave up:  $\left(-\frac{\sqrt{15}}{5}, 0\right), \left(\frac{\sqrt{15}}{5}, \infty\right)$  Concave down:  $\left(-\infty, -\frac{\sqrt{15}}{5}\right), \left(0, \frac{\sqrt{15}}{5}\right)$

$$14) f(x) = x^4 - 3x^2$$

Concave up:  $\left(-\infty, -\frac{\sqrt{2}}{2}\right), \left(\frac{\sqrt{2}}{2}, \infty\right)$  Concave down:  $\left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$

$$15) y = x^5 - 3x^3 - 1$$

Concave up:  $\left(-\frac{3\sqrt{10}}{10}, 0\right), \left(\frac{3\sqrt{10}}{10}, \infty\right)$  Concave down:  $\left(-\infty, -\frac{3\sqrt{10}}{10}\right), \left(0, \frac{3\sqrt{10}}{10}\right)$

$$16) y = x^3 - 2x^2 - 2$$

Concave up:  $\left(\frac{2}{3}, \infty\right)$  Concave down:  $\left(-\infty, \frac{2}{3}\right)$