Calculus Practice: Use Derivatives to Analyze Functions 9b

For each problem, find the open intervals where the function is concave up and concave down.

1) $f(x) = \dfrac{9x}{x^2 + 9}$

2) $f(x) = (6x + 18)^{\frac{1}{2}}$

3) $y = \dfrac{1}{5}(x - 4)^{\frac{5}{3}} + 2(x - 4)^{\frac{2}{3}} + 1$

4) $f(x) = (x + 6)^{\frac{1}{3}}$

5) $f(x) = -\dfrac{1}{4}(x + 3)^{\frac{8}{3}} + 4(x + 3)^{\frac{2}{3}} - 1$

6) $f(x) = \dfrac{1}{5}(x - 4)^{\frac{5}{3}} + 2(x - 4)^{\frac{2}{3}}$

7) $y = -\dfrac{x}{x + 1}$

8) $y = (5x + 10)^{\frac{1}{3}}$

9) $y = \cot(x);\ [-\pi, \pi]$

10) $f(x) = \tan(x);\ [-\pi, \pi]$

11) $y = 2\csc(2x);\ [-\pi, \pi]$

12) $f(x) = 2\sin(2x);\ [-\pi, \pi]$

13) $y = -\sec(x);\ [-\pi, \pi]$

14) $y = \csc(2x);\ [-\pi, \pi]$

15) $f(x) = \cos(2x);\ [-\pi, \pi]$

16) $y = -\tan(x);\ [-\pi, \pi]$

Calculus Practice: Use Derivatives to Analyze Functions 9b

For each problem, find the open intervals where the function is concave up and concave down.

1) $f(x) = \frac{9x}{x^2 + 9}$

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

2) $f(x) = (6x + 18)^{\frac{1}{2}}$

Concave up: No intervals exist. Concave down: $(-3, \infty)$

3) $y = \frac{1}{5}(x - 4)^{\frac{5}{3}} + 2(x - 4)^{\frac{2}{3}} + 1$

Concave up: $(6, \infty)$ Concave down: $(-\infty, 4), (4, 6)$

4) $f(x) = (x + 6)^{\frac{1}{3}}$

Concave up: $(-\infty, -6)$ Concave down: $(-6, \infty)$

5) $f(x) = -\frac{1}{4}(x + 3)^{\frac{8}{3}} + 4(x + 3)^{\frac{2}{3}} - 1$

Concave up: No intervals exist. Concave down: $(-\infty, -3), (-3, \infty)$

6) $f(x) = \frac{1}{5}(x - 4)^{\frac{5}{3}} + 2(x - 4)^{\frac{2}{3}}$

Concave up: $(6, \infty)$ Concave down: $(-\infty, 4), (4, 6)$

7) $y = -\frac{x}{x + 1}$

Concave up: $(-1, \infty)$ Concave down: $(-\infty, -1)$

8) $y = (5x + 10)^{\frac{1}{3}}$

Concave up: $(-\infty, -2)$ Concave down: $(-2, \infty)$

9) $y = \cot(x);\ [-\pi, \pi]$

Concave up: $\left(-\pi, -\frac{\pi}{2}\right), \left(0, \frac{\pi}{2}\right)$ Concave down: $\left(-\frac{\pi}{2}, 0\right), \left(\frac{\pi}{2}, \pi\right)$

10) $f(x) = \tan(x);\ [-\pi, \pi]$

Concave up: $\left(-\pi, -\frac{\pi}{2}\right), \left(0, \frac{\pi}{2}\right)$ Concave down: $\left(-\frac{\pi}{2}, 0\right), \left(\frac{\pi}{2}, \pi\right)$

11) $y = 2\csc(2x);\ [-\pi, \pi]$

Concave up: $\left(-\pi, -\frac{\pi}{2}\right), \left(0, \frac{\pi}{2}\right)$ Concave down: $\left(-\frac{\pi}{2}, 0\right), \left(\frac{\pi}{2}, \pi\right)$

12) $f(x) = 2\sin(2x);\ [-\pi, \pi]$

Concave up: $\left(-\frac{\pi}{2}, 0\right), \left(\frac{\pi}{2}, \pi\right)$ Concave down: $\left(-\pi, -\frac{\pi}{2}\right), \left(0, \frac{\pi}{2}\right)$

13) $y = -\sec(x);\ [-\pi, \pi]$

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

14) $y = \csc(2x);\ [-\pi, \pi]$

Concave up: $\left(-\pi, -\frac{\pi}{2}\right), \left(0, \frac{\pi}{2}\right)$ Concave down: $\left(-\frac{\pi}{2}, 0\right), \left(\frac{\pi}{2}, \pi\right)$

15) $f(x) = \cos(2x);\ [-\pi, \pi]$

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

16) $y = -\tan(x);\ [-\pi, \pi]$

Concave up: $\left(-\frac{\pi}{2}, 0\right), \left(\frac{\pi}{2}, \pi\right)$ Concave down: $\left(-\pi, -\frac{\pi}{2}\right), \left(0, \frac{\pi}{2}\right)$