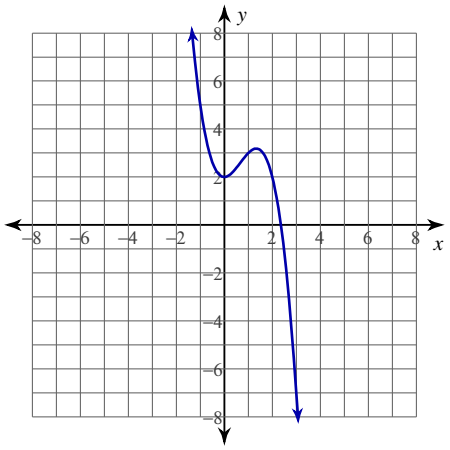
 Name_____

Intervals of Increase and Decrease

Date_____ Period____

For each problem, find the x-coordinates of all critical points, find all discontinuities, and find the open intervals where the function is increasing and decreasing.

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



2) $y = x^3 - 11x^2 + 39x - 47$

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

4) $y = \dfrac{x^2}{4x + 4}$

5) $y = \dfrac{3x^2 - 3}{x^3}$

6) $y = (2x - 8)^{\frac{2}{3}}$

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

Critical thinking question:

8) If functions f and g are increasing on an interval, show that $f + g$ is increasing on the same interval.

9) Give an example where functions f and g are increasing on the interval $(-\infty,\infty)$, but where $f - g$ is decreasing.

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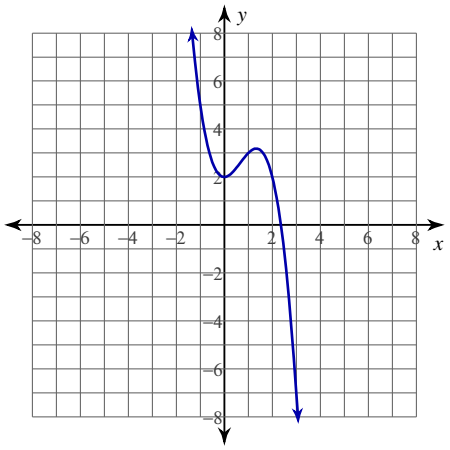

Critical points at: $x = 0, \frac{4}{3}$ No discontinuities exist.

Increasing: $\left(0, \frac{4}{3}\right)$ Decreasing: $(-\infty, 0), \left(\frac{4}{3}, \infty\right)$

2) $y = x^3 - 11x^2 + 39x - 47$

Critical points at: $x = 3, \frac{13}{3}$ No discontinuities exist.

Increasing: $(-\infty, 3), \left(\frac{13}{3}, \infty\right)$ Decreasing: $\left(3, \frac{13}{3}\right)$

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

Critical points at: $x = -\frac{\sqrt{6}}{2}, 0, \frac{\sqrt{6}}{2}$ No discontinuities exist.

Increasing: $\left(-\infty, -\frac{\sqrt{6}}{2}\right), \left(0, \frac{\sqrt{6}}{2}\right)$ Decreasing: $\left(-\frac{\sqrt{6}}{2}, 0\right), \left(\frac{\sqrt{6}}{2}, \infty\right)$

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

Critical points at: $x = -2, 0$ Discontinuity at: $x = -1$
Increasing: $(-\infty, -2), (0, \infty)$ Decreasing: $(-2, -1), (-1, 0)$

5) $y = \dfrac{3x^2 - 3}{x^3}$

Critical points at: $x = -\sqrt{3}, \sqrt{3}$ Discontinuity at: $x = 0$
Increasing: $(-\sqrt{3}, 0), (0, \sqrt{3})$ Decreasing: $(-\infty, -\sqrt{3}), (\sqrt{3}, \infty)$

6) $y = (2x - 8)^{\frac{2}{3}}$

Critical point at: $x = 4$ No discontinuities exist.
Increasing: $(4, \infty)$ Decreasing: $(-\infty, 4)$

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

Critical points at: $x = 0, 4$ No discontinuities exist.
Increasing: $(0, 4)$ Decreasing: $(-\infty, 0), (4, \infty)$

Critical thinking question:

8) If functions f and g are increasing on an interval, show that $f + g$ is increasing on the same interval.

We know that if $x_1 < x_2$, then $f(x_1) < f(x_2)$ and $g(x_1) < g(x_2)$. Therefore,
$f(x_1) + g(x_1) < f(x_2) + g(x_2)$.

9) Give an example where functions f and g are increasing on the interval $(-\infty,\infty)$, but where $f - g$ is decreasing.

Many answers. Ex: $f = x$ and $g = 2x$