

1 Problems

1. Solve the following:

(a) $\frac{2x-5}{x-2} < 1.$

(b) $3 \leq 4 - 2x < 7.$

(c) $\frac{\frac{1}{2}x-3}{4+x} > 1.$

(d) $-5 < \frac{3x+1}{x-2} < 1.$

(e) $\frac{2}{x} < \frac{3}{x-4}.$

(f) $x^3 - x^2 - x - 2 > 0.$

(g) $x^3 - 3x + 2 \leq 0.$

(h) $\frac{1}{6} < \frac{1}{x} < \frac{1}{2}.$

(i) $x < x^2 + 1 < 3.$

2. Solve the following:

(a) $|x+4| \geq 2.$

(b) $\frac{1}{|2x-3|} > 5.$

(c) $8 \geq |7x+1| > 3.$

(d) $\frac{1}{|x-1|} < 2.$

(e) $\left| \frac{x+5}{2-x} \right| \leq 6.$

(f) $\left| \frac{x-3}{x+5} \right| = 5.$

(g) $\frac{1}{|3x+1|} \geq 5.$

(h) $3 \leq |3x-5| \leq 9.$

3. Find $g \circ f$ and $f \circ g$ for the following:

(a) $f(x) = 2x + 1$ and $g(x) = x^2 - x$.

(b) $f(x) = \sqrt{x - 3}$ and $g(x) = \sqrt{x^2 + 3}$.

(c) $f(x) = 2 - x^2$ and $g(x) = x^3$.

(d) $f(x) = \frac{x}{x^2 + 1}$ and $g(x) = \frac{1}{x}$.

(e) $f(x) = \sin^2 x$ and $g(x) = \frac{3}{5 + \cos x}$.

(f) $f(x) = 3 \sin x^2$ and $g(x) = 3 \sin^2 x + 4 \cos x$.

(g) $f(x) = \sqrt{\sin x}$ and $g(x) = x^2 + 5$.

(h) $f(x) = \tan(\cot x)$ and $g(x) = x^3 \cos x$.

(i) $f(x) = x^3 - 3x$ and $g(x) = \sqrt{x}$.

4. Say whether the function is even, odd, or neither:

(a) $f(x) = 2$.

(b) $f(x) = x^{-5}$.

(c) $f(x) = x^4 + 3x^2 - 1$.

(d) $f(x) = -x^3$.

(e) $f(x) = x^3 + x$.

(f) $f(x) = 2|x| + 1$.

(g) $f(x) = \frac{x}{x^2 - 1}$.

(h) $f(x) = \frac{1}{x - 1}$.

(i) $f(x) = |x^3|$.

5. Sketch the graph of the following functions.

(a) $y = \sqrt{x+4}$.

(b) $y = \sqrt{9-x}$.

(c) $y = |x-2| + 3$.

(d) $y = 1 - \sqrt{x-1}$.

(e) $y = (x+1)^{\frac{2}{3}}$.

(f) $y = \frac{1}{x+5} - 2$.

(g) $y = 3 - 2x - x^2$.

(h) $y = \frac{1}{(x-1)^2} + 1$.

(i) $y = -\sin x$.

(j) $y = 2\sin(x+\pi)$.

(k) $y = -\cos(\pi-x)$.

6. Find the derivative for the following function:

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

(b) $y = (x^3+6)^6 + 7$.

(c) $y = (x^3+7x^2)(\frac{1}{x} + \frac{1}{x^2})$.

(d) $y = (x^5+2x)^2$.

(e) $y = \frac{3}{\sqrt{x}+2}$.

(f) $y = (2x+1)(1+\frac{1}{x})(x^{-3}+7)$.

(g) $y = \frac{(x+1)(x+2)}{(x-1)(x-2)}$.

(h) $y = (x+\frac{1}{x})(x-\frac{1}{x}+1)$.

(i) $y = \frac{1}{5x-3}$.

(j) $y = (3x^2+6)^7(2x-\frac{1}{4})^4$.

$$(k) \ y = (2 - x - 3x^3)(7 + x^5).$$

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

$$(m) \ y = (2x^7 - x^2)\left(\frac{x - 1}{x + 1}\right).$$

$$(n) \ y = \frac{1}{x} \left(x^2 \frac{1}{x} \right).$$

$$(o) \ y = \frac{1}{(x^2 - 1)(x^2 + x + 1)}.$$

$$(p) \ y = (\csc x + \cot x)^{-1}.$$

$$(q) \ y = x^2 \sin^4 x + x \cos^{-2} x.$$

$$(r) \ y = \frac{1}{x} \sin x - \frac{x}{3} \cos^3 x.$$

$$(s) \ y = \left(\frac{\sin x}{1 + \cos x} \right)^2.$$

$$(t) \ y = \cot \left(\frac{\sin x}{x} \right)^2.$$

$$(u) \ y = \log(\sin x).$$

$$(v) \ y = \log_3(\sqrt{x^2 + x + 1}).$$

$$(w) \ y = \log_5(\sin(\log x)).$$

$$(x) \ y = \log_2(\sec x + \tan x).$$

$$(y) \ y = e^{\sin x}.$$

$$(z) \ y = e^{\log(x \cos x)}.$$

7. Find y' in the following:

$$(a) \ x^2 y + y^2 x = x^3.$$

$$(b) \ \sqrt{y} x^4 + 5x^2 + y^2 = 7y.$$

$$(c) \ 2xy + 5y^2 = x^3.$$

$$(d) \ y + \sqrt{yx} = y^3.$$

$$(e) \ (x + y^2)(x - y^3) = 2.$$