

Practice Problems S2

1. If $f(x) = \frac{1+x}{1-x}$ and $g(x) = \frac{1}{x}$, find formulas for the functions $f + g$, $f - g$, $f g$, $\frac{f}{g}$, $\frac{g}{f}$, $f \circ g$, $g \circ f$, and specify their domains.
2. Express the following functions as compositions of two functions:
 - (a) $h(x) = \sqrt{1 - \sqrt[3]{x}}$
 - (b) $h(x) = \frac{\sqrt{x} - 3}{x + 5\sqrt{x} + 6}$
3. Check that the following functions are one-to-one. Find the inverses and specify their domains and ranges.
 - (a) $f(x) = \frac{x}{1+x}$
 - (b) $f(x) = (2x - 1)^3 - 8$
4. Simplify the following expressions
 - (a) $\frac{(a^5)^2 a^{-6}}{\sqrt[3]{a^2}}$
 - (b) $(1/3)^x 9^{x/2}$
 - (c) $x^{1/\log_a x}$
 - (d) $e^{3 \ln 2 - 4 \ln 3}$
 - (e) $2 \log_3 12 - 4 \log_3 6$
5. Solve the following equations for x :
 - (a) $\log_7(x^{\frac{3}{2}}) = 2 - \log_7 \sqrt{x}$;
 - (b) $2^{4-x^2} = \frac{1}{8^x}$;

$$(c) e^{2x} - e^x - 6 = 0;$$

$$(d) \ln(x) + \ln(x - 1) = \ln 6.$$

6. Evaluate the following limits if they exist or are infinity. Explain your answers.

$$(a) \lim_{x \rightarrow -2} (3x^2 - 2x + 8);$$

$$(b) \lim_{x \rightarrow \frac{3}{2}} \frac{2x - 3}{|2x - 3|};$$

$$(c) \lim_{x \rightarrow 0} \frac{1}{x\sqrt{x+1}} - \frac{1}{x};$$

$$(d) \lim_{x \rightarrow 2} \frac{4x - 8}{\sqrt{2x + 5} - \sqrt{x^2 + 5}};$$

$$(e) \lim_{x \rightarrow -2^-} \frac{x^2 + 2x}{x^2 - 4};$$

$$(f) \lim_{x \rightarrow -2^+} \frac{x^2 - 4}{x(x + 2)^2}.$$