

1. Solve.

a)  $x + \frac{8}{x} = -9$

b)  $\frac{x}{x-5} + \frac{5}{x} = \frac{11}{6}$

c)  $\frac{3}{x-2} = \frac{x+2}{7}$

d)  $\frac{7}{3x-9} - \frac{1}{x-3} = \frac{4}{9}$

e)  $\frac{5}{x+1} - \frac{1}{1-x} = \frac{1}{x^2-1}$

f)  $\frac{x+4}{x^3+8} + \frac{x+2}{x^2-2x+4} = \frac{11}{2x+4}$

g)  $\frac{x-4}{x^2+2x-15} = 2 - \frac{2}{x-3}$

h)  $\frac{y}{y+1} + \frac{3y+5}{y^2+4y+3} = \frac{2}{y+3}$

2. If  $f(x) = \frac{x+3}{4}$  and  $g(x) = \frac{x}{x-6}$ , find all values of  $x$  for which  $f(x) = g(x)$ .

3. Solve  $\frac{1}{a} + \frac{1}{b} = \frac{2}{h}$  for  $h$ .

4. Graph each rational function. Give the equations of the vertical and horizontal asymptotes.

a)  $f(x) = \frac{1}{x} - 2$

b)  $g(x) = \frac{1}{x-3}$

5. The focal length,  $f$ , of a thin lens is given by the *lensmaker's equation*,  $\frac{1}{f} = (n - 1) \left( \frac{1}{r_1} - \frac{1}{r_2} \right)$ , where  $n$  is the index of refraction of the lens material and  $r_1$  and  $r_2$  are the radii of the curvature of the lens surfaces.

a) Solve the formula for  $n$ .

b) Find the index of refraction of a glass lens if the focal length is 30 cm,  $r_1 = 2.5$  cm, and  $r_2 = 3$  cm.

6. The percent of deaths caused by smoking is modeled by the rational function defined by  $p(x) = \frac{x-1}{x}$ , where  $x$  is the number of times a smoker is more likely to die of lung cancer than a non-smoker is. This is called the incidence rate. For example,  $x = 10$  means that a smoker is 10 times more likely than a non-smoker to die of lung cancer.

a) Find  $p(x)$  if  $x$  is 10.

b) For what values of  $x$  is  $p(x) = 80\%$ ?

c) Can the incidence rate equal 0? Explain.