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

   (a) Evaluate and simplify completely
   - i. $g(-2)$
   - ii. $g(0)$
   - iii. $g(1)$
   - iv. $g(4)$
   - v. $g(x+3)$

   (b) Solve algebraically for $x$
   - i. $g(x) = 5$
   - ii. $g(x+2) = 4$
   - iii. $g(x) + 2 = 4$

2. Simplify the difference quotient $\dfrac{f(x+h) - f(x)}{h}$ for the following functions

   (a) $f(x) = x^2 + 2x + 3$

   (b) $f(x) = x^3 - 5$

   (c) $f(x) = \dfrac{4}{x}$

3. Simplify the following completely with a common denominator. Your answer should not contain negative exponents.

   (a) $\dfrac{4x}{x-1} - \dfrac{5x+2}{2x}$

   (b) $\dfrac{(b+2)^x}{(b+2)^{4x-2}}$

   (c) $\dfrac{1+2t}{\sqrt{t+3}} + 2\sqrt{t+3}$

   (d) $\dfrac{(x^2+1)\frac{1}{2\sqrt{x}} - 2x\sqrt{x}}{(x^2+1)^2}$

   (e) $\dfrac{2}{x+5} - \dfrac{3}{x-5}$

   (f) $\dfrac{4(z+2)^{1/2} - 2z(z+2)^{-1/2}}{z+2}$

   (g) $\dfrac{a^n 3^{n+1}}{3^n a^{n+1}}$

   (h) $e^x e^{1-x}$

   (i) $\dfrac{(x^3+1)^2 - 6x^3(x^3+1)}{(x^3+1)^4}$

   (j) $\dfrac{5}{\sqrt{1-z^2}} - 3\sqrt{1-z^2}$

   (k) $\dfrac{2x(x^2+5)^{1/2} - x^2(x^2+5)^{-1/2}(2x)}{x^2+5}$

   (l) $\dfrac{\frac{1}{(x+h)^2} - \frac{1}{x^2}}{h}$

   (m) $\dfrac{\frac{1}{x} - \frac{1}{y}}{\frac{1}{x^2} - \frac{1}{y^2}}$

   (n) $\dfrac{3}{\frac{3}{x-1} - 1}$

4. Solve each of the following for the indicated variable. Give exact solutions.

(a) $e^{5x} + e^{5x} = 1$ ; for $x$

(b) $\dfrac{1+ax}{x-2} = 4b$ ; for $x$

(c) $\log(x) + \log(x-21) = 2$ ; for $x$

(d) $\dfrac{a}{x} + \dfrac{b}{2x} = 1$ ; for $x$

(e) $6y^{-2} + y = 0$; for $y$

(f) $10te^{3t} + 2t^2e^{3t} = 0$ ; for $t$

(g) $\dfrac{(p-1)\,(p^2-11)}{(p-2)(p+3)} = 0$ ; for $p$

(h) $3^t = 12(.8)^t$ ; for $t$

(i) $\ln(t+2) - \ln(t) = \ln 7$ ; for $t$

(j) $\sqrt{x-1} - 10 = 2$ ; for $x$

(k) $x^2y - x^3 = 2(2y+3)$ ; for $y$

(l) $(3-x)^3 = -13$ ; for $x$

(m) $3(ax+1) - 2x = 4(a-ax)$ ; for $x$

(n) $9xe^{ax} - 3x^2e^{ax} = 0$ ; for $x$

(o) $(x+1)(x+3) = 15$ ; for $x$

(p) $\ln(\ln(x)) = 1$ ; for $x$

(q) $\log(x) - \log(x-1) = 1$ ; for $x$

(r) $A(.83)^x = B(b)^x$ ; for $x$

(s) $\dfrac{3x}{5} - \dfrac{2}{x} = \dfrac{1}{5}$ ; for $x$

5. Solve each of the following for the indicated variable. Give exact solutions.

(a) $(x-4)(x+2) = 7$ ; for $x$

(b) $\log(x+4) = 2 - \log(x+1)$ ; for $x$

(c) $4xe^x - 3e^x = 0$ ; for $x$

(d) $4(x+1)^2 - 5 = 0$ ; for $x$

(e) $\dfrac{5y-2}{y-2} = 0$ ; for $y$

(f) $0 = 4z^3 + 6z^2 - 24z - 36$ ; for $z$

(g) $\dfrac{1-4y}{1+2y} + 2 = 0$ ; for $y$

(h) $t^2 - t - 6 = 14$ ; for $t$

(i) $2t - (3t+4) = 5(t+2)$ ; for $t$

(j) $x^2 + \dfrac{2y}{x} = y + 3$ ; for $y$

(k) $Ax + By + C = 0$ ; for $y$

(l) $t^3 - 16t^{-1} = 0$ ; for $t$

(m) $\ln(t+2) - \ln(t) = \ln(\pi)$ ; for $t$

(n) $\dfrac{3p^2+p-2}{p-7} = 0$ ; for $p$

(o) $\dfrac{1}{R} = \dfrac{1}{a} + \dfrac{1}{b}$ ; for $R$

6. Determine whether each statement is True or False.

(a) $\sqrt{x^2+121} = x+11$

(b) $\sqrt{4} = \pm 2$

(c) $\dfrac{\frac{x+3}{3}}{3} = \dfrac{x+3}{9}$

(d) $\dfrac{\frac{w+1}{2}}{w+1} = \dfrac{1}{2}$ for $w \neq -1$

(e) $\ln(e^x e^y) = x+y$

(f) $e^{\ln(x)+5} = xe^5$

(g) $\ln(M) - \ln(B) = \dfrac{\ln(M)}{\ln(B)}$

(h) $\ln\left(\sqrt{a}\right) = \dfrac{1}{2}\ln(a)$

(i) $2^{x+y} = 2^x + 2^y$

(j) $\log\left(ab^t\right) = t\log(ab)$

(k) $\ln\left(e^x + e^y\right) = x+y$

(l) $\sqrt[3]{r^3-64} = r-4$

(m) $\dfrac{x^{-1}+2}{x} = \dfrac{2}{x^2}$

(n) $\dfrac{x^2+3x+1}{x^2} = 3x+1$

(o) $e^{-3^2} = e^9$

7. Determine whether each statement is True or False.

(a) $8(2t+1)^3 = (4t+2)^3$

(b) $(e^x)^2 = e^{2x}$

(c) $\dfrac{1}{x-4} = \dfrac{-1}{4-x}$

(d) $(x+1)^2 + 2(x+1) = (x+1)(x+3)$

(e) $\dfrac{1}{3t^4} = (3t)^{-4}$

(f) $\ln(1) = e$

(g) $\dfrac{1}{\sqrt[3]{(z-8)^2}} = (z-8)^{-2/3}$

(h) $\dfrac{1}{a^{-1}+b^{-1}} = a+b$

(i) $2^t = t\ln 2$

(j) $\dfrac{1}{x+2} = \dfrac{1}{x} + \dfrac{1}{2}$

(k) $\dfrac{\log(x)}{\log(t)} = \dfrac{\ln(x)}{\ln(t)}$

(l) $\dfrac{Ax^2+B}{x} = Ax+B$

(m) $\log(x+y) = \log(x)\log(y)$

(n) $e^{4\ln(x)} = 4x$

(o) $(1+y)^3 = 1+y^3$

(p) If $f(x) = 5^x$, then $f(x+4) = 5^x + 4$

8. Simplify each of the following.

   (a) $\dfrac{2x^{2/3}\left(x^2-3\right)(2x)-\frac{2}{3}x^{-1/3}\left(x^2-3\right)^2}{\left(x^2-3\right)^{3/2}}$

   (b) $\dfrac{1-\frac{1}{x}}{\frac{1}{x}-x}$

9. Solve the quadratic functions by **completing the square**

   (a) $z^2-5z-8=0$

   (b) $3w^2-2w-15=0$

10. Solve each of the following for the indicated variable. Give exact solutions.

    (a) $e^{2x}-2e^x-3=0$ ; for $x$

    (b) $1-\dfrac{1}{1+x}=k$ ; for $x$

    (c) $2\ln(5x)=\ln(x+2)$ ; for $x$

    (d) $(2x+5)^2+5(2x+5)-36=0$ ; for $x$

    (e) $10^{2x}+3\left(10^x\right)-10=0$ ; for $x$

    (f) $\sqrt{x+9}-2=\sqrt{x-3}$ ; for $x$

    (g) $\left(\dfrac{1}{x+8}\right)^2+\dfrac{1}{x+8}-6=0$ ; for $x$

    (h) $\dfrac{12}{z}-\dfrac{7}{z+1}=1$ ; for $z$

    (i) $\ln(t)+2t=\ln(8)$ ; for $t$

**2b** $3x^2 + 3xh + h^2$

**2c** $\dfrac{-4}{x(x+h)}$

**3a** $\dfrac{3x^2+3x+2}{2x(x-1)}$

**3b** $\dfrac{1}{(b+2)^{3x-2}}$

**3c** $\dfrac{4t+7}{\sqrt{t+3}}$

**3d** $\dfrac{1-3x^2}{2\sqrt{x}\,(x^2+1)^2}$

**3e** $\dfrac{x+25}{25-x^2}$

**3f** $\dfrac{2z+8}{(z+2)^{3/2}}$

**3g** $\dfrac{3}{a}$

**3h** $e$

**3i** $\dfrac{-5x^3+1}{(x^3+1)^3}$

**3j** $\dfrac{3z^2+2}{\sqrt{1-z^2}}$

**3k** $\dfrac{10x}{(x^2+5)^{3/2}}$

**3l** $\dfrac{-2x+h}{x^2(x+h)^2}$

**3m** $\dfrac{xy}{y+x}$

**3n** $\dfrac{3x-1}{4-x}$

**4a** $x = \frac{1}{5}\ln(\frac{1}{2})$
$= -\frac{1}{5}\ln(2)$

**4c** $x = 25$

**4d** $x = a + \frac{1}{2}b$

**4e** $y = -\sqrt[3]{6}$

**4h** $t = \dfrac{\ln 12}{\ln 3 - \ln .8}$
$= \dfrac{\ln 12}{\ln(\frac{15}{4})}$

**4j** $x = 145$

**4k** $y = \dfrac{x^3+6}{x^2-4}$

**4p** $x = e^e$

**4r** $x = \dfrac{\ln A - \ln B}{\ln b - \ln(.83)}$
$= \dfrac{\ln(\frac{A}{B})}{\ln(\frac{b}{.83})}$

**5a** $x = -3, 5$

**5f** $z = -\sqrt{6}, -3/2, \sqrt{6}$

**5i** $t = -7/3$

**5j** $\dfrac{x^3-3}{x-2}$

**5m** $t = \dfrac{2}{\pi - 1}$

**5o** $R = \dfrac{ab}{a+b}$

**6a** **F**

**6b** **F**

**6c** **T**

**6d** **T**

**6e** **T**

**6f** **T**

**6g** **F**

**6h** **T**

**6i** **F**

**6j** **F**

**6k** **F**

**6l** **F**

**6m** **F**

**6n** **F**

**6o** **F**

**7a** **T**

**7b** **T**

**7c** **T**

**7d** **T**

**7e** **F**

**7f** **F**

**7g** **T**

**7h** **F**

**7i** **F**

**7j** **F**

**7k** **T**

**7l** **F**

**7m** **F**

**7n** **F**

**7o** **F**

**7p** **F**

**8b** $\dfrac{-1}{x+1}$

**10a** $x = \ln 3$

**10d** $x = -7, -1/2$

**10f** $x = 7$

**10h** $z = -2, 6$