Answers - Quadratics (page ??)

1. $(2^2)^x + 2^x - 24 = 0$

   $(2^x)^2 + 2^x - 24 = 0$

   Making the substitution $u = 2^x$

   $u^2 + 2u - 24 = 0$

   $u = 4.42, -5.42$

   2^x can never be negative so we can ignore the -5.42 solution.

   $2^x = 4.42$

   $\ln 2^x = \ln 4.42$

   $x \ln 2 = \ln 4.42$

   $x = \frac{\ln 4.42}{\ln 2}$

   $x = 2.14$ (1dp)

2. Rearrange to $9^x - 6^x - 4^x = 0$

   We need a constant so divide through by the lowest term.

   $\frac{9^x}{4^x} - \frac{6^x}{4^x} - \frac{4^x}{4^x} = 0$

   $(\frac{9}{4})^x - (\frac{6}{4})^x - 1 = 0$

   $((\frac{3}{2})^2)^x - (\frac{3}{2})^x - 1 = 0$

   $((\frac{3}{2})^x)^2 - (\frac{3}{2})^x - 1 = 0$

   Use the substitution $u = (\frac{3}{2})^x$

   $u^2 - u - 1 = 0$

   $u - 1.618, -0.618$

   $(\frac{3}{2})^x$ can never be negative so we ignore -0.618.

   $(\frac{3}{2})^x = 1.618$

   $\ln (\frac{3}{2})^x = \ln 1.618$

   $x \ln(\frac{3}{2}) = \ln 1.6.18$

   $x = \frac{\ln 1.618}{\ln \frac{3}{2}}$

   $x = 1.187$

3. We need a constant so divide through by the lowest term.

   $8(\frac{9^x}{4^x}) + 3(\frac{6^x}{4^x}) - 81 = 0$

$8(\frac{9}{4})^x + 3(\frac{6}{4})^x - 81 = 0$

$8((\frac{3}{2})^2)^x + 3(\frac{3}{2})^x - 81 = 0$

$8((\frac{3}{2})^x)^2 + 3(\frac{3}{2})^x - 81 = 0$

Use the substitution $u = (\frac{3}{2})^x$

$8u^2 + 3u - 81 = 0$

$u = 3, -3.375$

Since $(\frac{3}{2})^x$ can never be negative, we can ignore the -3.375 solution.

$(\frac{3}{2})^x = 3$

$\ln{(\frac{3}{2})^x} = \ln 3$

$x \ln{(\frac{3}{2})} = \ln 3$

$x = \frac{\ln 3}{\ln \frac{3}{2}}$=2.71

4. We need a constant so divide through by the lowest term.

   $(\frac{25^x}{9^x}) + 2(\frac{15^x}{9^x}) - 24 = 0$

   $(\frac{25}{9})^x + 2(\frac{15}{9})^x - 24 = 0$

   $((\frac{5}{3})^2)^x + 2(\frac{5}{3})^x - 24 = 0$

   $((\frac{5}{3})^x)^2 + 2(\frac{5}{3})^x - 24 = 0$

   Use the substitution $u = (\frac{5}{3})^x$

   $u^2 + 2u - 24 = 0$

   $u = 4, -6$

   Since $(\frac{5}{3})^x$ can never be negative, we can ignore the -6 solution.

   $(\frac{5}{3})^x = 4$

   $\ln{(\frac{5}{3})^x} = \ln 4$

   $x \ln{(\frac{5}{3})} = \ln 4$

   $x = \frac{\ln 4}{\ln \frac{5}{3}}$=2.714