Name: _____ Date: _____

## 7.2 Techniques for Solving Exponential Equations

BLM 7–3

**1.** Solve for $t$. Round answers to two decimal places.

**a)** $5 = (1.12)^t$ **b)** $7 = 2(1.06)^{2t+1}$

**c)** $4 = \left(\frac{1}{8}\right)^{t-3}$ **d)** $6.5 = 1.5\left(\frac{1}{2}\right)^{\frac{t}{15}}$

**2.** The amplitude of a vibration decays according to the equation $a = 4.5(0.65)^{\frac{t}{60}}$, where $a$ is the size of the amplitude, in centimetres, at time $t$, in seconds.

**a)** What will the amplitude be after 30 s, to the nearest tenth of a centimetre?

**b)** How long (to the nearest second) will it take the amplitude to decay to 30% of its original value?

**c)** Would it take twice as long as your answer for part b) for the amplitude to decay to 15% of its original value? Explain.

**3.** Solve each equation. Leave answers in exact form.

**a)** $3^{x-3} = 4^{x-4}$ **b)** $7^{2x-3} = 2^{-3x}$

**4.** Consider the equation $3^{2x} - 4(3)^x + 1 = 0$.

**a)** Write the equation in the form $az^2 + bz + c = 0$, where $z = 3^x$.

**b)** Solve the equation using the quadratic formula.

**c)** Identify any extraneous roots.

**5.** A 25-mg sample of radioactive francium decays to 20 mg in 13.6 min.

**a)** Determine the half-life of francium.

**b)** Graph the amount of francium remaining over a 2-h period.

**c)** On the same set of axes as part b), sketch the graph of the amount of an element if

**i)** it has the same half-life as francium, but the original amount was 30 mg

**ii)** it has the same original mass as the francium sample, but its half-life is twice as long

**6.** Solve and check for extraneous roots. Leave answers in exact form.

**a)** $3^{2x} - 6(3)^x - 27 = 0$

**b)** $2^x = 2 + 3(2)^{-x}$

**c)** $5^{2x} + 1 = 3(5)^x$

**7.** The population of a colony of bacteria grows according to the formula $P(t) = 4(1.40)^{\frac{t}{24}}$, where $P$ is the population, in thousands, and $t$ is the time, in hours.

**a)** How long does it take the population to reach 10 000, to the nearest hour?

**b)** Calculate the time it takes for the population to double, to the nearest hour.

**8.** The maximum height that a ball reaches after bounce number $n$ is given by the equation $H = 2.0(0.90)^n$, where $H$ is the height, in metres.

**a)** What is the ball's maximum height after the fifth bounce?

**b)** What is the first bounce after which the maximum height is less than 10 cm?

**9.** Solve $4^x + 2^{x+2} = 32$.

**10.** Rewrite the equation $P(t) = 4(1.40)^{\frac{t}{24}}$ with base 1.40 replaced with 2.

**11.** The general equation for population growth is $P(t) = P_0\left(1 + \frac{R}{100}\right)^{\frac{t}{t_0}}$, where $R$ is the growth rate, in percent, over time period $t_0$. Suppose a population grew from 10 000 to 25 000 in six years. If time is measured in years, calculate

**a)** the yearly growth rate

**b)** the growth rate per decade (10 years)