1) Evaluate.

a) $\log_2 16^3$

$= 3\log_2(2^4)$
$= 3(4)$
$= 12$

b) $\log_4 8^2$

$= \log_4 64$
$= \log_4(4^3)$
$= 3$

c) $\log 100^{-4}$

$= -4\log(10^2)$
$= -4(2)$
$= -8$

d) $\log 0.1^{\frac{1}{2}}$

$= \frac{1}{2}\log(10^{-1})$
$= \frac{1}{2}(-1)$
$= -\frac{1}{2}$

e) $\log_2 \sqrt{8}$

$= \frac{1}{2}\log(2^3)$
$= \frac{1}{2}(3)$
$= \frac{3}{2}$

f) $\log_3\left(\sqrt[3]{81}\right)^6$

$= \log_3\left(81^{\frac{1}{3}}\right)^6$
$= \log_3(81)^2$
$= 2\log_3(3^4)$
$= 2(4)$
$= 8$

2) Solve for t to two decimal places.

a) $10 = 4^t$

$\log_4 10 = t$

$\frac{\log 10}{\log 4} = t$

$t = 1.66$

b) $5^t = 250$

$\log_5 250 = t$

$\frac{\log 250}{\log 5} = t$

$t = 3.43$

c) $2 = 1.08^t$

$\log_{1.08} 2 = t$

$\frac{\log 2}{\log 1.08} = t$

$t = 9.01$

d) $500 = 100(1.06)^t$

$5 = 1.06^t$

$\log_{1.06} 5 = t$

$\frac{\log 5}{\log 1.06} = t$

$t = 27.62$

3) An investment earns 7% interest, compounded annually. The amount, A, that the investment is worth as a function of time, t, in years, is given by $A(t) = 500(1.07)^t$.

a) Use the equation to determine the value of the investment after 4 years.

$A(4) = 500(1.07)^4$
$= \$655.40$

b) How long will it take for the investment to double in value?

$1000 = 500(1.07)^t$

$2 = 1.07^t$

$\log_{1.07} 2 = t$

$\frac{\log 2}{\log 1.07} = t$

$t = 10.2 \text{ years}$

4) Use the change of base formula to evaluate each of the following. Round to 3 decimal places.

a) $\log_3 23$

$$= \frac{\log 23}{\log 3}$$

$$= 2.854$$

b) $\log_6 20$

$$= \frac{\log 20}{\log 6}$$

$$= 1.672$$

c) $-\log_{12} 4$

$$= -\frac{\log 4}{\log 12}$$

$$= -0.558$$

d) $\log_{\frac{1}{2}} 30$

$$= \frac{\log 30}{\log\left(\frac{1}{2}\right)}$$

$$= -4.907$$

5) Write each as a single logarithm

a) $\dfrac{\log 8}{\log 5}$

$$= \log_5 8$$

b) $\dfrac{\log 17}{\log 9}$

$$= \log_9 17$$

c) $\dfrac{\log\left(\frac{1}{2}\right)}{\log\left(\frac{2}{3}\right)}$

$$= \log_{\frac{2}{3}}\left(\frac{1}{2}\right)$$

d) $\dfrac{\log(x+1)}{\log(x-1)}$

$$= \log_{(x-1)}(x+1)$$

6)a) Evaluate $\log_2 8^5$ without using the power law of logarithms.

$$= \log_2 (2^3)^5$$

$$= \log_2 (2^{15})$$

$$= 15$$

b) Evaluate the same expression by applying the power law of logarithms.

$$= 5 \cdot \log_2 (2^3)$$

$$= 5(3)$$

$$= 15$$

c) Which method do you prefer?

answers will vary

7) Solve for x, correct to 3 decimal places.

a) $2 = \log 3^x$

$$2 = x \cdot \log 3$$

$$\frac{2}{\log 3} = x$$

$$x = 4.192$$

b) $100 = 10 \log 1000^x$

$$10 = \log 1000^x$$

$$10 = x \log 1000$$

$$\frac{10}{\log 1000} = x$$

$$x = 3.333$$

c) $4 = \log_3 15^x$

$$3^4 = 15^x$$

$$81 = 15^x$$

$$\log 81 = \log 15^x$$

$$\log 81 = x \cdot \log 15$$

$$x = \frac{\log 81}{\log 15}$$

$$x = 1.623$$

<u>**ANSWER KEY**</u>

1) 12 **b)** 3 **c)** -8 **d)** $-\frac{1}{2}$ **e)** $\frac{3}{2}$ **f)** 8   **2)a)** 1.66 **b)** 3.43 **c)** 9.01 **d)** 27.62   **3)a)** \$655.40 **b)** 10.2 years

4)a) 2.854 **b)** 1.672 **c)** -0-.558 **d)** -4.907   **5)a)** $\log_5 8$ **b)** $\log_9 17$ **c)** $\log_{\frac{2}{3}}\left(\frac{1}{2}\right)$ **d)** $\log_{(x-1)}(x+1)$

6)a) 15 **b)** 15 **c)** answers will vary   **7)a)** 4.192 **b)** 3.333 **c)** 1.623