Name: _____

HSN.Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HSF-BF.B.5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
HSF-LE.A.4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

A) Write as a single logarithm:

1) $2 - \frac{1}{2}\log 4 - \log 6$

$$\log 10^2 - \log 4^{\frac{1}{2}} - \log 6$$

$$\log \frac{10^2}{2 \times 6}$$

1) $\frac{1}{2}\ln 9 + \ln 2$

$$\ln 9^{\frac{1}{2}} + \ln 2$$

$$\ln (3 \times 2)$$

2) $4\ln 2 + 2$

$$\ln 2^4 + \ln e^2$$

$$\ln (2^4 \times e^2)$$

B) Solve for x without using calculator (i.e. show steps):
1) $x = \ln(e\sqrt{e})$

$$= \ln (e^1 \cdot e^{\frac{1}{2}})$$

$$= \ln e^{1.5}$$

$$= 1.5$$

2) $\log_3(x^2 + 5) = 2$

$$x^2 + 5 = 3^2 \qquad \bigg| \quad x = \pm 2$$

$$x^2 = 4$$

3) $\log_5(2x - 1) = 0$

$$2x - 1 = 5^0 \qquad \bigg| \quad x = 1$$

$$2x - 1 = 1$$

$$2x = 2$$

4) $\log 6 = \log(x + 5) + \log(x)$

$$\log 6 = \log(x(x+5)) \qquad \bigg| \quad (x+6)(x-1) = 0$$

$$6 = x^2 + 5x \qquad\qquad\qquad x = -6 \qquad x = +1$$

$$0 = x^2 + 5x - 6$$

5) $3 \ln x - 2 \ln x = 1$ (write the answer in terms of e)

$$\ln x^3 - \ln x^2 = 1 \qquad \bigg| \quad x = e$$

$$\ln \frac{x^3}{x^2} = 1$$

$$\ln x = \ln e$$

C) The temperature (T) of a liquid t minutes after it is placed in a refrigerator, is given by $T = 4 + 96 \times (e^{-0.03t})$ °C. Find the time required for the temperature to reach $25°$ C. Write the answer to the nearest minute.

$$25 = 4 + 96 e^{-0.03t}$$

$$\frac{21}{96} = e^{-0.03t}$$

$$\ln \frac{21}{96} = -0.03t$$

$$t = \frac{\ln \frac{21}{96}}{-0.03} = 51 \; minutes.$$

Grade 10 B Logarithms Quiz- February 8th 2017

Name: **Answer Key**

HSN-Q.A.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

HSF-BF.B.5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

HSF-LE.A.4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology

A) Write as a single logarithm:

1) $3 + \log 2 + \log 7$

$$\log 10^3 + \log 2 + \log 7$$
$$\log (10^3 \times 2 \times 7)$$

2) $6 \log 2 - 3 \log 5$

$$\log 2^6 - \log 5^3$$
$$\log \frac{2^6}{5^3}$$

3) $4 \ln 2 + 2 \ln 3$

$$\ln 2^4 - \ln 3^2$$
$$= \ln \frac{2^4}{3^2}$$

B) Solve for x without using calculator (i.e. show steps):

1) $x = \ln\left(\frac{e}{e^3}\right)$

$$x = \ln \frac{1}{e^2} = \ln e^{-2} = -2$$

2) $\log_2(x + 2) = 2$

$$x + 2 = 2^2$$

$$x = 4 - 2 = 2$$

3) $\log_5(2x) = 1$

$$2x = 5^1$$

$$x = \frac{5}{2}$$

4) $\log x + \log(x + 1) = \log 30$

$$\log(x(x+1)) = \log 30$$

$$x^2 + x = 30 \qquad (x-5)(x+6) = 0$$

$$x^2 + x - 30 = 0 \qquad x = 5, \ x \neq -6$$

5) $\log_{10}(x^2 - 3x + 6) = 1$

$$x^2 - 3x + 6 = 10^1$$

$$x^2 - 3x - 4 = 0 \qquad x = 4$$

$$(x-4)(x+1) = 0 \qquad x = -1$$

C) The weight of a radioactive isotope remaining after t weeks is given by

$$W_t = 8000 \, e^{-\frac{t}{20}} \text{ grams.}$$

Find the time (to the nearest week) for the weight to reach 1000g.

$$1000 = 8000 \, e^{-t/20}$$

$$\frac{1000}{8000} = e^{-t/20}$$

$$e^{-t/20} = \frac{1}{8}$$

$$\ln\frac{1}{8} = -\frac{t}{20}$$

$$t = -20 \ln\frac{1}{8}$$

$$t = 42 \text{ weeks}$$