

Wherever possible solve problems without the use of a calculator. Show middle steps to reveal your method.

1. Evaluate without a calculator.

- a) $\log_3 18 + \log_3 1.5$ b) $\log_2 \left(\frac{4}{3}\right) + \log_2 24$ c) $\log_2 320 - \log_2 10$
 d) $\log_3 216 - \log_3 8$ e) $\log_2 16 + \log_3 8$ f) $\log_5 100 - \log_5 4 + \log_3 81$

2. Find the value of each:

- a) $\log_2 4^{25}$ b) $\log_3 \sqrt{27}$ c) $\log_2 (64 \sqrt[3]{2})$
 d) $\log_2 \frac{1}{\sqrt{16}}$ e) $\log_2 (8\sqrt{32}) + \log_7 (49 \sqrt[4]{7})$ f) $\log_9 (3\sqrt{27}) + \log_{81} 3$

3. Write as a single logarithm:

- a) $\log 6 + \log 10 + \log 3$ b) $2\log_4 3 + 3\log_4 2$ c) $3\log 3 - \log 2 + \log 4$

4. Solve:

- a) $\log 6 + \log 9 = \log x$ b) $\log 3 = \log x - \log 5$ c) $\log x + \log 5 - \log 55 = 0$
 d) $\log_{10} 25 - \log_{10} 5 = \log_{10} x$ e) $\log_3 x - \log_3 4 = \log_3 12$ f) $-\log_5 1 = \log_5 7 - \log_5 x$

5. Solve:

- a) $\log_2 x = 2\log_2 8$ b) $4\log_7 x = \log_7 625$
 c) $\log_7 (x-2) = 1 - \log_7 (x+4)$ d) $\log_{10} (x+5) + \log_{10} (x-4) = 1$
 e) $\log_5 (7x+1) - \log_5 (x-1) = 2$ f) $\log_7 (2x+2) - \log_7 (x-1) = \log_7 (x+1)$
 g) $2\log_4 x = \log_4 64$ h) $3(4)^{6x+5} = 25$ i) $5^{2x} - 5^x - 20 = 0$

6. Solve:

- a) $2^{3x} = 16$ b) $2^{x^2+5x} = \frac{1}{16}$ c) $\log_4 (x^2 - 6x) = 2$

Answers:

1. a) 3 b) 5 c) 5 d) 3 e) 6 f) 6
 2. a) 50 b) $\frac{3}{2}$ c) $\frac{19}{3}$ d) -2 e) $\frac{31}{4}$ f) $\frac{3}{2}$
 3. a) $\ln 180$ b) $\log_4 72$ c) $\ln 54$
 4. a) 54 b) 15 c) 11 d) 5 e) 48 f) 7
 5. a) 64 b) 5 c) 3 d) 5 e) $\frac{13}{9}$ f) 3
 g) 8 h) $\frac{\log 25 - \log 3 - 5\log 4}{6\log 4}$ i) 1
 6. a) $\frac{4}{3}$ b) -1 or -4 c) -2 or 8

Logarithmic Review

Date: _____

1. If you start with 1000 bacteria initially, how many would you have after 4 hours if the doubling time is 30 minutes?
2. A product of a nuclear process has a half-life of 10 years. This means that if it has a mass of 1 kg, after 10 years, it will have a mass of 0.5 kg. If you start with 1 kg, how many mg would be left after 100 years?
3. The population of mice in a field doubles every 10 years. If there are 25 mice now, how many will there be in 6 years?
4. Strontium-90 has a half-life of 25 years. How long would it take for a 20 mg sample to decay to a mass of 2 mg?
5. Bill puts \$100 in a bank account which pays interest at the rate of 5% per annum compounded semi-annually. How much money will he have after 6 years?
6. Harris invests \$1 000 in an account which pays interest at a rate of 1% per month compounded monthly. How much would there be in the account after one year?
7. Mr. Brar is a tapioca pudding addict. He is given 10 kg of the pudding on Christmas Day. He eats one-half of it that day, and half of what is left each day until New Year's Day. How much is left after New Years Day?
8. In a Star Trek, the Next Generation, episode Captain Picard tries out a new space probe which has an initial velocity of 3 m/s but which doubles its velocity every 5 seconds. How fast is it going after one minute?
9. The great earthquake of India had a Richter reading of 8.7. A slight tremor occurring in California had a reading of 2.5. How many times more intense was the earthquake in India?
10. The remains of a flowering plant were found to have 0.36 g of carbon-14. It was estimated that the plant originally had 2.9 g of carbon-14. Calculate the age of the plant, if the half-life of carbon-14 is 5 760 years.
11. A lake in Muskoka region has a pH of 4. How does the concentration of hydrogen ions in the lake compare to clean rain water which has a pH of 5.6?
12. To provide for a down payment on a recreation property, the Watson's invest their savings of \$3 832.82 at 9% compounded semi-annually. If the down payment required is \$6 500, how long does the money need to be invested?

Answers:

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- | | | | |
|-------------|------------------|---------------------|--------------|
| 1. 256 000 | 2. 977mg | 3. 38 | 4. 83 years |
| 5. \$134.49 | 6. \$1 126.83 | 7. 0.039 kg | 8. 12288 m/s |
| 9. 158 4893 | 10. 17 338 years | 11. 39.8 times more | 12. 6 years |