Review #1: Basic Math

All exercises should be done without calculators.

A.   Simplify. Assume all variables represent non-zero real numbers. Write all answers with only positive exponents.

1. $(3^{-2})^3$

2. $(-2^2)^3$

3. $(2/3)^{-3}$

4. $6^{12} \cdot 6^{10}$

5. $-3^2 \cdot 2^3$

6. $\dfrac{-5^{-2}}{5^{-3}}$

7. $m^6 \cdot m^{-8}$

8. $f^x \cdot f^{3x}$

9. $\dfrac{a^{-2}a^4}{a^6 a^{-13}}$

10. $5(-2b)^2 (b^3)^6$

11. $\dfrac{-3^4 \omega^2 \rho^{-3}}{(-6)^3 \omega^{-8} \rho^5}$

12. $\dfrac{(\sin \phi)^2 (\sin \phi)^{-8}}{(\sin \phi)^6}$

13. $\dfrac{(x+y)^3 (x+y)^2 (x+y)^{-8}}{(x+y)^5 (x+y)^{-16}}$

14. $\dfrac{\left(a^3 b^{-2} c^5\right)^{-4}\left(-2a^2 b^4 c\right)^3 \left(-3ac^{-2}\right)^{-2}}{\left(2a^6 b^3\right)^4 \left(-b^{-3} c^5\right)^{-2}}$

15. $[(\psi + \lambda)^2 (\psi + \lambda)^{-3}(\psi + \lambda)^{15} + (\psi + \lambda)^8 (\psi + \lambda)^2]^0$

B.   Simplify. Assume all variables represent positive real numbers.

1. $8^{2/3}$

2. $\sqrt{3.6 \times 10^5}$

3. $5^{1/4} 5^{7/4}$

4. $\sqrt[3]{\left(3 \times 10^2\right)\left(9 \times 10^{10}\right)}$

5. $-2^2 \cdot 3^3$

6. $\sqrt[3]{-64}$

7. $\sqrt[5]{\dfrac{(x+y)^2}{(x+y)^7}}$

8. $\sqrt{\dfrac{36}{81}}$

9. $\sqrt[5]{-m^{10} n^{25}}$

10. $\sqrt[4]{\left(100^2\right)\left(10^6\right)\left(1000^2\right)}$

11. $\dfrac{r^{\frac{1}{4}} r^{\frac{1}{2}}}{r^{\frac{3}{4}}}$

12. $\left(\dfrac{z^{-1} x^{-3/5}}{2^{-2} z^{-1/2} x}\right)^{-5}$

13. $\dfrac{\sqrt[3]{\sigma \mu^2} \sqrt[3]{\sigma^5 \mu^{-2}}}{\sqrt[3]{\sigma^8 \mu^4} \sqrt[3]{\sigma^7 \mu^5}}$

14. $3\sqrt{8} - 5\sqrt{2}$

C.   Rewrite each relation using logarithmic notation.

1. $x^3 = 4$

2. $2^{-5} = \dfrac{1}{32}$

3. $b^p = E$

4. $4^x = 64$

D. Rewrite each relation in exponential form.

   1. $\log_b 3 = E$ 2. $\log_{10} 1000 = 3$ 3. $\log_3 x = y$ 4. $\log_8(1/8) = -1$

E. Write each of the following as a single logarithm. Assume all variables represent positive real numbers. Simplify as much as possible.

   1. $\log_b 3\mu + \log_b 7$ 2. $\log_4 2 + \log_4 8$ 3. $6\log_x m - 2\log_x q$ 4. $x\log_b 3 - 3\log_b 3^x$

F. Solve each equation for the indicated variable. Simplify your results.

   1. Solve for $\mu: 3\mu + \Delta = 3\Delta + \mu$ 2. Solve for q: $\dfrac{1}{f} = \dfrac{1}{p} + \dfrac{1}{q}$

   3. Solve for $t: x = vt + \frac{1}{2}at^2$ 4. Solve for $\beta: \beta - 3\phi + 90 = 5\beta + 4\phi + 180$

   5. Solve for $v: mgh = \frac{1}{2}mv^2 + mgy$ 6. Solve for a: Mg - Ma = μmg + ma.

   7. i. Solve for t: $x_f = x_i + v_i t + \frac{1}{2}$ a t^2
      ii. Find t when x_i = 0 m, x_f = 18.75 m, v_i = 0 m/s, and a = 1.5 m/s^2.
      iii. Find t when x_i = 18.75 m, x_f = 32.25 m, v_i = 7.5 m/s, and a = - 2.0 m/s^2.