Title: Simplifying expressions with exponents
Class: Math 100
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Instructions to tutor: Read instructions under "Activity"
Keywords/Tags: exponents, negative exponents, simplify expressions with exponents, properties of exponents

Objective: Simplifying expressions with integer exponents can be difficult, especially when there are several steps involved. Multi-step problems are important in developing skills that help us organize our thoughts, increase our attention span, and write correct and detailed mathematical work. This activity will start with basic problems and build up to ones that require more work.

Activity: Review properties of exponents and list all of them on this sheet. Simplify each expression using these properties. Note the similarities and differences in the problems. Have a tutor check your work when you're done with problems 1-15 before you proceed with the rest.

Properties
 of
Exponents:

1. $\dfrac{a^9}{a^3}$

2. $\dfrac{a^3}{a^9}$

3. $\dfrac{a^9}{a^{-3}}$

4. $\dfrac{a^{-9}}{a^3}$

5. $\dfrac{a^{-9}}{a^{-3}}$

6. $\dfrac{9a^9}{3a^3}$

7. $\dfrac{3a^3}{9a^9}$

8. $\dfrac{3a^9}{9a^{-3}}$

9. $\dfrac{-3a^{-9}}{9a^3}$

10. $\dfrac{9a^{-9}}{-3a^{-3}}$

11. $\dfrac{2^9}{2^3}$

12. $\dfrac{2^3}{2^9}$

13. $2^9 - 2^3$

14. $2^0 - 2^3$

15. $2^0 - 2^{-3}$

Make sure you check with a tutor before you go on to the rest of this worksheet.

16. $\left(\dfrac{3a^9}{9a^3}\right)^{-2}$

17. $\left(\dfrac{3a^9 b^7}{9a^3 b^2}\right)^{-2}$

18. $\left(\dfrac{3a^9 b^2}{9a^3 b^7}\right)^{-2}$

Remember that you must always simplify as much as you can INSIDE any parentheses.

19. $\left(3a^3b^{-2}\right)^4$

In this expression, note the difference between how the two 3's are affected by the 4th power outside the parentheses. Explain this difference, then simplify the expression.

20. $\left(3a^3b^{-2}\right)^4 \left(a^{-3}b^7\right)^2$

21. $\dfrac{\left(3a^3b^{-2}\right)^4}{\left(a^{-3}b^7\right)^2}$

Compare this problem with #20. What do you do the same and what do you differently in these problems? Also compare this problem with #18.

22. $\left(3a^3b^{-2}\right)^{-4} \left(6a^3b^7\right)^2$

After you go over the previous problems with a tutor, try the following, then check with a tutor to make sure you did them correctly.

Simplify each expression using properties of exponents. Make sure your answers contain positive exponents only.

1. $\dfrac{a^{12}}{a^7}$

2. $\dfrac{a^{-12}}{a^7}$

3. $\dfrac{a^{12}}{4a^{-7}}$

4. $\dfrac{-3a^{-12}}{a^{-7}}$

5. $\dfrac{12a^{12}}{-2a^{-2}}$

6. $\dfrac{12a^{-12}}{-2a^{-2}}$

7. $\dfrac{3^8}{3^4}$

8. $3^8 - 3^4$

9. $3^0 - 3^2$

10. $3^0 - 3^{-2}$

11. $\left(5a^{-2}\right)^3$

12. $\left(5a^{-2}\right)^0$

13. $\left(5a^0\right)^{-2}$

14. $\left(\dfrac{2a^2b^7}{8a^8b^2}\right)^{-2}$

15. $\left(2a^2b^{-4}\right)^{-3}\left(4a^3b^4\right)^2$