Pre-Test Unit 1: Exponents KEY

No calculator necessary. Please do not use a calculator.

Evaluate, meaning multiply out the exponent, giving your answer as a fraction when necessary. *(5 pts; 2 pts for only simplifying but not evaluating)*

1. $\frac{3^{-1}}{3^2} = \frac{1}{27}$

2. $(2^3)^{-4} \times 2^8$

3. $(7^{12})(7^{-10}) = 49$

4. $\frac{(t^7)(t^4)}{t^5}$

5. $(x^{-2})^{-6} = x^{12}$

6. $(m^5)(m^{-2})$

Determine if the following equations are true. Justify your answer. *(5 pts; 2 pts for answer, 3 pts for justification)*

7. $j^2 \times j^{-7} = j^{-2} \times j^{-3}$

True; $\frac{1}{j^5} = \frac{1}{j^5}$

8. $\frac{8^5}{8^0} = (8^3)^2$

Determine the appropriate exponent to make the equation true. *(5 pts; no partial credit)*

9. $(3^{-4})^4 = (3^8)^{\boxed{-2}}$

10. $\frac{b^{-2} \times b^8}{b^5} = \frac{b^{\square}}{b^3}$

Write the following numbers in scientific notation. *(5 pts; 2 pts for correct digits, 3 pts for correct power of ten)*

11. $5{,}070{,}000{,}000 = 5.07 \times 10^9$

12. $0.000\ 000\ 27$

Write the following numbers in standard form. *(5 pts; 2 pts for moving the decimal in the correct direction)*

13. $3.4 \times 10^7 = 34{,}000{,}000$

14. 9.7×10^{-5}

Choose the best unit of measurement for the following problems. *(5 pts; no partial credit)*

15. A plant grows approximately 3×10^{-4} meters per day. Would this be best expressed using kilometers, meters, or millimeters of growth per day?

Compute the EXACT answer to each of the following questions giving your answer in scientific notation.
(5 pts; 2 pts for correct digits, 3 pts for correct power of ten)

16. $(4.3 \times 10^{-9})(2 \times 10^{6})$

17. $\frac{2.4 \times 10^{8}}{20{,}000}$

$= 1.2 \times 10^{4}$

18. $6.3 \times 10^{6} + 3{,}200{,}000$

ESTIMATE the answer to each of the following questions giving your answer as single digit times a power of ten.
(5 pts; 2 pts for correct digits, 3 pts for correct power of ten)

19. A town has about $19{,}000$ people living in it and the mayor wants to send each person $\$19{,}000$ as a celebration gift because the town won the Federal Lottery for Small Towns. (They'd been buying tickets for years and finally hit the jackpot!) How much money would the town need to give out this celebration gift?

$\approx 4 \times 10^{8}$

20. A soccer ball has a volume of about $5{,}800\ cm^3$ and a baseball $220\ cm^3$. How many times bigger in volume is a soccer ball than a baseball?

Lesson 1.1

Unit 1 Homework Key

Perform the following operations leaving your answer as a number to a power. Remember that the parentheses can mean multiply as well.

1. $5^3 \times 5^7 = 5^{10}$
2. $(12^9)(12^0)$
3. $\frac{(t^5)(t^4)}{t^2} = t^7$
4. $\frac{4^{13}}{4^7} \times 4^{10}$
5. $\frac{f^5}{f} = f^4$
6. $\frac{u^{11}}{u^4}$
7. $(5^4)^5 = 5^{20}$
8. $(b^3)^6 \times (b^2)^9$
9. $(j^{11})^5 = j^{55}$

Evaluate, meaning multiply out the exponents.

10. $3^2 \times 3^2$
11. $\frac{(2^{10})(2^2)}{2^9} = 8$
12. $\frac{(5^3)^2}{5^4}$
13. $\frac{4^{12}}{4^{10}} = 16$
14. $(5^3)^1 \times 5^0$
15. $(1^4)^2 = 1$

Determine if the following equations are true. Justify your answer.

16. $12^2 \times 12^7 = 12^6 \times 12^3$
17. $\frac{x^8}{x^3} = \frac{x^5}{x}$
    False; $x^5 \neq x^4$
18. $(t^5)^2 = (t^2)^5$
19. $(5^{10})^2 = (5^5)^5$
    False; $5^{20} \neq 5^{25}$
20. $\frac{6^0 \times 6^8}{6^4} = \frac{6^4}{6^0}$
21. $m^5 \times m^5 = (m^{10})^0$
    False; $m^{10} \neq m^0$
22. $\frac{k^6}{k^2} = k^2 \times k^6$
23. $\frac{(7^4)^2}{7^3} = 7^3 \times 7^2$
    True; $7^5 = 7^5$
24. $\frac{3 \times 3^4}{3^4} = (3^5)^1$

Determine the appropriate exponent to make the equation true.

25. $2^5 \times 2^{\boxed{1}} = 2^3 \times 2^3$
26. $\frac{p^6}{p^2} = \frac{p^7}{p^{\square}}$
27. $(3^4)^3 = (3^6)^{\boxed{2}}$
28. $(5^{10})^2 = (5^{\square})^5$
29. $\frac{b^2 \times b^8}{b^{\boxed{6}}} = \frac{b^7}{b^3}$
30. $9^{\square} \times 9^8 = (9^3)^5$
31. $\frac{h^{\boxed{10}}}{h^2} = h^3 \times h^5$
32. $\frac{(6^{11})^{\square}}{6^6} = 6^8 \times 6^8$
33. $\frac{3^{\boxed{0}} \times 3^9}{3^2} = (3^7)^1$

Lesson 1.2

Evaluate the following negative exponents giving your answer as a fraction.

1. $5^{-3} = \frac{1}{125}$ 2. 2^{-2} 3. $3^{-2} = \frac{1}{9}$ 4. 7^{-2} 5. $4^{-3} = \frac{1}{64}$ 6. 10^{-3}

7. $10^{-2} = \frac{1}{100}$ 8. 1^{-14} 9. $6^{-2} = \frac{1}{36}$ 10. 2^{-4} 11. $9^{-1} = \frac{1}{9}$ 12. 5^{-2}

13. $10^{-4} = \frac{1}{10{,}000}$ 14. 8^{-1} 15. $3^{-4} = \frac{1}{81}$ 16. 6^{-1} 17. $4^{-2} = \frac{1}{16}$ 18. 11^{-1}

Simplify the negative exponents giving your answer as a fraction.

19. $a^{-3} = \frac{1}{a^3}$ 20. b^{-2} 21. $c^{-5} = \frac{1}{c^5}$ 22. d^{-6} 23. $f^{-11} = \frac{1}{f^{11}}$ 24. g^{-13}

25. $h^{-1} = \frac{1}{h}$ 26. j^{-4} 27. $k^{-20} = \frac{1}{k^{20}}$ 28. m^{-9} 29. $n^{-7} = \frac{1}{n^7}$ 30. p^{-10}

Lesson 1.3

Evaluate the following exponents operations giving your answer as a fraction where necessary.

1. $5^3 \times 5^{-4} = \frac{1}{5}$
2. $(12^9)(12^{-7})$
3. $\frac{(t^{-5})(t^4)}{t^2} = \frac{1}{t^3}$
4. $\frac{4^3}{4^{-7}} \times 4^{-10}$
5. $\frac{f^5}{f^{-1}} = f^6$
6. $(y^{-4})^{-5}$
7. $(2^3)^{-6} \times (2^2)^7 = \frac{1}{16}$
8. $12^2 \times 12^{-4}$
9. $\frac{(k^{-3})^2}{k^4} = \frac{1}{k^{10}}$
10. $\frac{4^{-2}}{4}$
11. $(5^{-3})^2 \times 5^9 = 125$
12. $(0^{-4})^{10}$

Determine if the following equations are true. Justify your answer.

13. $12^{-2} \times 12^7 = 12^{-8} \times 12^3$
False; $12^5 \neq \frac{1}{12^5}$
14. $\frac{x^{-5}}{x^{-3}} = \frac{x^5}{x^7}$
15. $(t^{-5})^2 = (t^{-2})^5$
True; $\frac{1}{t^{10}} = \frac{1}{t^{10}}$
16. $(5^{10})^2 = (5^{-5})^{-4}$
17. $\frac{6^{-6} \times 6^8}{6^4} = \frac{6^{-2}}{6^0}$
True; $\frac{1}{6^2} = \frac{1}{6^2}$
18. $m^7 \times m^7 = (m^{-7})^2$
19. $\frac{k^{-6}}{k^2} = k^2 \times k^{-10}$
True; $\frac{1}{k^8} = \frac{1}{k^8}$
20. $\frac{(7^{-4})^2}{7^3} = 7 \times 7^{12}$
21. $\frac{3 \times 3^4}{3^{10}} = (3^5)^{-1}$
True; $\frac{1}{3^5} = \frac{1}{3^5}$

Determine the appropriate exponent to make the equation true.

22. $2^5 \times 2^{\square} = 2^{-6} \times 2^3$
23. $\frac{p^6}{p^{-2}} = \frac{p^{\boxed{10}}}{p^2}$
24. $(3^{-4})^3 = (3^{-2})^{\square}$
25. $(5^{12})^{-2} = (5^3)^{\boxed{-8}}$
26. $\frac{b^{-2} \times b^8}{b^5} = \frac{b^{\square}}{b^3}$
27. $9^2 \times 9^{-8} = (9^{\boxed{-2}})^3$
28. $\frac{h^{-2}}{h^{\square}} = h^3 \times h^{-5}$
29. $\frac{(6^2)^{\boxed{3}}}{6^6} = 6^{-8} \times 6^8$
30. $\frac{3^{-4}}{3^{\square} \times 3^9} = (3^7)^{-1}$

Lesson 1.4

Round each number to a single digit times a power of ten.

1. 1,234,000
$\approx 1 \times 10^{6}$

2. 190,000

3. 99,000,000
$\approx 1 \times 10^{8}$

4. 3,499,000

5. 0.000 000 42
$\approx 4 \times 10^{-7}$

6. 0.000 019

7. 0.000 000 016 87
$\approx 2 \times 10^{-8}$

8. 0.007

Rewrite each number in scientific notation.

9. 5,390,000,000
$= 5.39 \times 10^{9}$

10. 10,900,000,000

11. 7,800,000,000
$= 7.8 \times 10^{9}$

12. 873,000,000

13. 0.000 000 000 321
$= 3.21 \times 10^{-10}$

14. 0.000 001 987

15. 0.000 000 008 5
$= 8.5 \times 10^{-9}$

16. 0.000 023 9

17. The Earth has an approximate mass of $5{,}980{,}000{,}000{,}000{,}000{,}000{,}000{,}000\ kg$.
$= 5.98 \times 10^{24}$
$\approx 6 \times 10^{24}$

18. A quarter (meaning the coin) is 0.000 000 25 of a million dollars.

19. The mass of a dust particle is $0.000\ 000\ 000\ 753\ kg$.
$= 7.53 \times 10^{-10}$
$\approx 8 \times 10^{-10}$

20. The speed of light is $299{,}792{,}458\ m/sec$.

Rewrite each number in standard form.

21. 2.3×10^{13}
$= 23{,}000{,}000{,}000{,}000$

22. 6.07×10^{7}

23. 5×10^{11}
$= 500{,}000{,}000{,}000$

24. 1.8×10^{3}

25. 2.3×10^{-11}
$= 0.000\ 000\ 000\ 023$

26. 6.07×10^{-9}

27. 5×10^{-5}
$= 0.000\ 05$

28. 1.8×10^{-6}

Choose the most appropriate unit of measurement for the given situation.

29. The amount of lava coming from a volcano: fluid ounces per hour, cups per hour, or gallons per hour

30. The speed human hair grows: inches per year, feet per year, or yards per year

31. The growth of a tree: inches per hour, inches per year, yards per year

32. Speed of a swimming dolphin: centimeters per hour, meters per hour, kilometers per hour

33. The rate of water flow from a shower head: fluid ounces per minute, cups per minute, gallons per minute

34. A cell phone measures 2.3×10^{-5} kilometers in thickness. Would this be best expressed using kilometers, meters, or centimeters?

35. The average pace for a biker is 3.2×10^{6} centimeters per hour. Would this be best expressed using kilometers, meters, or centimeters?

36. A bullet travels 3.4×10^{5} millimeters per second. Would this be best expressed using millimeters, centimeters, or meters per second?

Lesson 1.5

Compute the EXACT answer to each of the following questions giving your answer in scientific notation.

1. $(3 \times 10^{-6})(3 \times 10^{9})$
$= 9 \times 10^{3}$

2. $\frac{6.8 \times 10^{9}}{2 \times 10^{5}}$

3. $4.5 \times 10^{7} + 41{,}000{,}000$
$= 8.6 \times 10^{7}$

4. $8.4 \times 10^{7} - 3.1 \times 10^{7}$

5. $(2.4 \times 10^{4})(3{,}000)$
$= 7.2 \times 10^{7}$

6. $\frac{5.4 \times 10^{8}}{3{,}000}$

7. $3.9 \times 10^{13} + 4.2 \times 10^{13}$
$= 8.1 \times 10^{13}$

8. $8.2 \times 10^{-5} - 0.000\,059$

9. $(1.3 \times 10^{-4})(4.2 \times 10^{11})$
$= 5.46 \times 10^{7}$

10. $\frac{4.5 \times 10^{9}}{1.5 \times 10^{13}}$

11. $1.3 \times 10^{7} + 4 \times 10^{7}$
$= 5.3 \times 10^{7}$

12. $5.2 \times 10^{7} - 12{,}000{,}000$

ESTIMATE the answer to each of the following questions giving your answer as single digit times a power of ten.

13. How many times bigger is the distance from Earth to the sun of 9.3×10^6 miles than the furthest distance from Earth to the moon of 3×10^5 miles?

$$\approx 3 \times 10^1 \; times \; farther$$

14. The temperature halfway to the Sun from Mercury is approximately $1{,}800° \; C$ and scientists theorize that it may be up to $26{,}000$ times hotter at the center of the Sun. Approximately how hot is it at the center of the Sun?

15. Each shrimp weighs approximately $0.000\;27 \; g$ and a shrimp company can bring in over $3{,}100{,}000{,}000$ shrimp per year. Approximately how much would that many shrimp weigh?

$$\approx 9 \times 10^5 \;\; g$$

16. The Earth has a mass of about 1×10^{25} kg. Neptune has a mass of 1.8×10^{27} kg. How many times bigger is Neptune than Earth?

17. A country has an area of approximately $8{,}400{,}000{,}000$ square miles and has approximately $210{,}000$ people. How much area is this per person?

$$\approx 4 \times 10^4 \; sq.miles/person$$

18. A blue whale can eat $300{,}000{,}000$ krill in a day. All of that krill weighs approximately $6{,}300{,}000{,}000 \; mg$. About how much does each krill weigh?

19. The US spends on average $10{,}200$ dollars on each student per year. There are about $77{,}000{,}000$ students in the United States. How about much money total is spent on students each year?

$$\approx 8 \times 10^{11} \; dollars$$

20. McDonald's has about $210{,}000$ managers and each makes on average $39{,}000$ dollars per year. How much money does McDonald's spend on managers each year?

Review Unit 1: Exponents KEY

No calculator necessary. Please do not use a calculator.

Unit 1 Goals

- *Know and apply the properties of integer exponents to generate equivalent numerical expressions. (8.EE.1)*
- *Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (8.EE.3)*
- *Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology. (8.EE.4)*

Evaluate, meaning multiply out the exponent, giving your answer as a fraction when necessary.

1. $4^4 \times 4^{-2}$

16

2. $(3^2)(3^{-5})$

3. $(6^2)^0$

1

4. $\frac{3^4}{3^9}$

5. $(v^6)^{-3}$

$\frac{1}{v^{18}}$

6. $\frac{b^8}{b^{-2}}$

7. $(k^{-10})(k^{-2})$

$\frac{1}{k^{12}}$

8. $(5^{-3})^{-1}$

9. $\frac{2^{-6}\times 2^3}{2^{-5}}$

4

10. $(j^3)^{-2} \times j^6$

11. $\frac{(m^{-3})^5}{m^5}$

$\frac{1}{m^{20}}$

12. $\frac{4^6}{4^{-2}} \times 4^{-6}$

Determine if the following equations are true. Justify your answer.

13. $8^{-5} \times 8^6 = 8^0 \times 8$

True, $8^1 = 8^1$

14. $(j^2)^{-5} = \frac{j^{10}}{j^2}$

15. $\frac{m^3 \times m^{-5}}{m^2} = \frac{m^4}{m^0}$

False, $m^{-4} \neq m^4$

16. $(4^{-5})^4 = (4^{10})^{-2}$

Determine the appropriate exponent to make the equation true.

17. $\frac{p^5}{p^{-5}} = (p^2)^{\square}$

5

18. $2^{-10} \times 2^2 = 2^{-4} \times 2^{\square}$

19. $\frac{f^0}{f^{-7}} = \frac{f^{14}}{f^{\square}}$

7

20. $\frac{(9^2)^4}{9^{-2}} = \left(9^{\square}\right)^2$

Write the following numbers in scientific notation.

21. 9,089,000,000
9.089×10^9

22. 810,000,000,000

23. 0.000 000 27
2.7×10^{-7}

24. 0.001 06

Write the following numbers in standard form.

25. 5.14×10^{-6}
0.000 005 14

26. 4.07×10^9

27. 3.1×10^{-7}
0.000 000 31

28. 7.109×10^4

Choose the best unit of measurement for the following problems.

29. Would the weight of a strand of hair, about 6.9×10^{-5} grams, be best expressed using tons, pounds, or milligrams?

Milligrams

30. Would the area of the City of Charleston, about 24.9×10^{11} square centimeters, be best expressed using square kilometers, square meters, or square millimeters?

Estimate each of the following as a single digit times a power of ten. Then compute each of the following giving your answer in scientific notation.

31. $(2.1 \times 10^6)(500)$
$\approx 1 \times 10^9$
1.05×10^9

32. $\frac{6.3 \times 10^7}{3 \times 10^3}$

33. $4.2 \times 10^7 - 3{,}000{,}000$
$\approx 4 \times 10^7$
3.9×10^7

34. $6.2 \times 10^{-6} + 0.000\,005$

35. $\frac{4.8 \times 10^3}{4 \times 10^6}$
$\approx 1 \times 10^{-3}$
1.2×10^{-3}

36. $(3 \times 10^{-9})(2{,}300)$

Answer the following questions giving <u>both</u> an estimated answer (single digit times a power of ten) and a precise answer (scientific notation).

37. In the United States, there are approximately 300,000,000 people that use a total of approximately 360,000,000,000 gallons of water in a day. How much water does each person use?

$\approx 1 \times 10^3$
1.2×10^3

38. A football field has an area of 56,560 ft^2 and a tennis court 2,800 ft^2. How many times bigger in area is a football field than a tennis court?

39. Three thousand people sued McDonald's for hot coffee and were compensated at least \$280,000 for each person. How much money was distributed in total?

$\approx 9 \times 10^8$
8.4×10^8

40. There were 9,700,000 Macintosh computers sold in 2008. If Macintosh earns an average of \$200 profit per computer sold, how much profit did the company make selling computers in 2008?