

READY, SET, GO! Name _____ Period _____ Date _____

HM3
 WTA
 D2

READY

Topic: Properties of exponents

Use the product rule or the quotient rule to simplify. Leave all answers in exponential form with only positive exponents.

- | | | | |
|--------------------------------|---|--------------------------------------|---|
| 1. $3^6 \cdot 3^5$ 3^{11} | 2. $7^2 \cdot 7^6$ 7^8 | 3. $10^{-4} \cdot 10^7$ 10^3 | 4. $5^9 \cdot 5^{-6}$ 5^3 |
| 5. $p^2 p^5$ p^7 | 6. $2^6 \cdot 2^{-3} \cdot 2^1$ 2^4 | 7. $b^{11} b^{-5}$ b^6 | 8. $\frac{7^5}{7^2}$ 7^3 |
| 9. $\frac{9^8}{9}$ 9^7 | 10. $\frac{3^5}{3^8}$ $3^{-3} = \frac{1}{3^3}$ | 11. $\frac{7^{-4}}{7^{-8}}$ 7^4 | 12. $\frac{p^{-3}}{p^5}$ $\frac{1}{p^8}$ |

STOP

SET

Topic: Inverse function

13. Given the functions $f(x) = \sqrt{x} - 1$ and $g(x) = x^2 + 7$:
- Calculate $f(16)$ and $g(3)$.
 - Write $f(16)$ as an ordered pair. $(16, 3)$
 - Write $g(3)$ as an ordered pair. $(3, 16)$
 - What do your ordered pairs for $f(16)$ and $g(3)$ imply? *inverses?*
 - Find $f(25)$. 4
 - Based on your answer for $f(25)$, predict $g(4)$. 25
 - Find $g(4)$. 23 Did your answer match your prediction? **no**
 - Are $f(x)$ and $g(x)$ inverse functions? **no** Justify your answer.

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READY, SET, GO!

Name _____

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READY

Topic: Solving exponential equations.

Solve for the value of x .

1. $5^{x+1} = 5^{2x-3}$

$x = 4$

2. $7^{3x-2} = 7^{-2x+8}$

$5x = 10$
 $x = 2$

3. $4^{3x} = 2^{2x-8}$

$(2^2)^{3x} = 2^{2x-8}$
 $6x = 2x - 8$
 $x = -2$

4. $3^{5x-4} = 9^{2x-3}$

$5x - 4 = 2(2x - 3)$
 $5x - 4 = 4x - 6$
 $x = -2$

5. $8^{x+1} = 2^{2x+3}$

$3x + 3 = 2x + 3$
 $x = 0$

6. $3^{x+1} = \frac{1}{81}$

$x + 1 = -4$
 $x = -5$

SET

Topic: Exploring the inverse of an exponential function

In the fairy tale *Jack and the Beanstalk*, Jack plants a magic bean before he goes to bed. In the morning Jack discovers a giant beanstalk that has grown so large, it disappears into the clouds.

But here is the part of the story you never heard. Written on the bag containing the magic beans was this note.

Plant a magic bean in rich soil just as the sun is setting. Do not look at the plant site for 10 hours. (This is part of the magic.) After the bean has been in the ground for 1 hour, the growth of the sprout can be modeled by the function $b(t) = 3^t$. (b in feet and t in hours)

Jack was a good math student, so although he never looked at his beanstalk during the night, he used the function to calculate how tall it should be as it grew. The table on the right shows the calculations he made every half hour.

Hence, Jack was not surprised when, in the morning, he saw that the top of the beanstalk had disappeared into the clouds.

| Time (hours) | Height (feet) |
|--------------|---------------|
| 1 | 3 |
| 1.5 | 5.2 |
| 2 | 9 |
| 2.5 | 15.6 |
| 3 | 27 |
| 3.5 | 46.8 |
| 4 | 81 |
| 4.5 | 140.3 |
| 5 | 243 |
| 5.5 | 420.9 |
| 6 | 729 |
| 6.5 | 1,262.7 |
| 7 | 2,187 |
| 7.5 | 3,788 |
| 8 | 6,561 |
| 8.5 | 11,364 |
| 9 | 19,683 |
| 9.5 | 34,092 |
| 10 | 59,049 |

1x = 18

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SOLVING EXPONENTIAL EQUATIONS

SOLVE.

$$\textcircled{1} \quad 5^{2x+3} = \sqrt[3]{5^{x+4}}$$

$$5^{2x+3} = \left(5^{\frac{1}{2}}\right)^{x+4}$$

$$5^{2x+3} = 5^{\frac{1}{2}x+2}$$

$$2x+3 = \frac{1}{2}x+2$$

$$-\frac{1}{2}x \quad -\frac{1}{2}x$$

$$\frac{3}{2}x + 3 = 2$$

$$\frac{3}{2}x = -1 \cdot \frac{2}{3}$$

$$\boxed{x = -\frac{2}{3}}$$

$$\textcircled{2} \quad \left(\frac{1}{32}\right)^{x+2} = \left(\frac{1}{8}\right)^{x-4}$$

$$\left(\frac{1}{2^5}\right)^{x+2} = \left(\frac{1}{2^3}\right)^{x-4}$$

$$\left(2^{-5}\right)^{x+2} = \left(2^{-3}\right)^{x-4}$$

$$-5x-10 = 3x+12$$

$$-2x = 22$$

$$\boxed{x = -11}$$

$$(3) \quad 6^{2n+3} \cdot 6^{2n} = 1$$

$$6^{2n+3} \cdot 6^{2n} = 6^0$$

ADD

$$6^{4n+3} = 6^0$$

$$4n+3 = 0$$

$$\begin{array}{r} -3 \\ -3 \\ \hline n = -\frac{3}{4} \end{array}$$

$$x = \frac{-2}{11}$$
$$(5) \quad \frac{64^{-3x}}{16^{x+1}} = 1$$

$$(4) \quad 625^{3x-1} \cdot 25 = 5^2$$

$$(5^4)^{3x-1} \cdot (5^2)^{-2x} = 5^2$$

ADD

$$5^{12x-4} \cdot 5^{-4x} = 5^2$$

$$5^{8x-4} = 5^2$$

$$8x-4 = 2$$

$$\frac{8x}{8} = \frac{6}{8}$$

$$\boxed{x = \frac{3}{4}}$$

Compound Interest

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

amount after t yrs. principle (initial) ^{rate} _{number of times compounded} ^{time (yrs.)}

~~⊗~~ Compound continuously: $A = Pe^{rt}$
'population problems'

Compound Interest

For each problem, write out what each variable means, write the equation, and find the given values.

1. Heather received \$100 for her 13th birthday. If she saves it in a bank with 5% interest compounded quarterly, how much money will she have in the bank by her 16th birthday?

A = ? P = \$100 r = .05 n = 4 t = $\frac{3}{(16-13)}$

Formula/work:

$$A = 100 \left(1 + \frac{.05}{4}\right)^{(4 \cdot 3)} = \underline{\underline{\$116.08}}$$

2. How much would you have to invest in order to have \$700 after 2 years at 18% APR if the interest is compounded:

A = 700 P = ? r = .18 t = 2

a. annually n = 1 b. semiannually n = 2

$$700 = P(1 + .18)^{2 \cdot 1}$$

$$700 = P(1.3924)$$

$$P = \underline{\underline{\$502.73}}$$

c. bimonthly n = 24 2×12

d. quarterly n = 4

$$700 = P \left(1 + \frac{.18}{4}\right)^{4 \cdot 2}$$

$$700 = P(1.422)$$

$$P = \underline{\underline{\$492.23}}$$

3. How long would it take you to double your investment of \$1,800 if the interest is 12% compounded:

A = _____ P = _____ r = _____ t = _____

a. quarterly n = _____ b. weekly n = _____

c. semiannually n = _____ d. 3 times a year n = _____

P

$$r = .125$$

4. Roland earned \$3,500 over the summer. If he deposited the money in a certificate of deposit that earns 12.5% interest compounded continuously, how much money will he have by next summer?

$$A = 3500e^{(.125 \cdot 1)} = \underline{\underline{\$3966.02}}$$

$t = 1$
 $A = ?$

5. The FRESH company has a savings plan for their employees. If an employee makes an initial contribution of \$2,500 and the company pays 7.5% interest compounded continuously, how much money will the employee have after 10 years?

6. Juan invests \$7,500 at 12.25% interest for two years. How much money would he have if the interest was compounded:

a. Semiannually

c. monthly

b. Weekly

d. continuously

7. Determine the amount of an investment if \$250 is invested at an interest rate of 10.3% compounded quarterly for 40 years.

8. Lorena is investing her \$5000 inheritance from her aunt in a certificate of deposit that matures in 4 years. The interest rate is 8.25% compounded quarterly. What is the balance of the account after 4 years?