SP How Long Does it Take?

Rational Exponents:

Write each expression in exponential form:

1. $\left(\sqrt[3]{v}\right)^7$ $v^{7/3}$

2. $\left(\sqrt[4]{5x}\right)^3$ $(5x)^{3/4}$

3. $\sqrt[7]{x^4}$ $x^{4/7}$

4. $\left(\sqrt[3]{4y}\right)^4$ $(4y)^{4/3}$

5. $\dfrac{1}{\left(\sqrt[5]{y}\right)^{11}}$ $\dfrac{1}{y^{11/5}}$

6. $\dfrac{1}{\left(\sqrt[6]{3b}\right)^5}$ $\dfrac{1}{(3b)^{5/6}}$

Write each expression in radical form. :

7. $y^{\frac{2}{3}}$ $\left(\sqrt[3]{y}\right)^2$

8. $b^{\frac{1}{4}}$ $\sqrt[4]{b}$

9. $n^{\frac{-5}{3}}$ $\dfrac{1}{\left(\sqrt[3]{n}\right)^5}$

10. $(2c)^{\frac{-2}{5}}$ $\dfrac{1}{\left(\sqrt[5]{2c}\right)^2}$

11. $(6x)^{\frac{1}{7}}$ $\sqrt[7]{6x}$

12. $(12y)^{\frac{3}{8}}$ $\left(\sqrt[8]{12y}\right)^3$

Simplify:

13. $81^{\frac{3}{4}}$ $\left(\sqrt[4]{81}\right)^3$ 3^3 27

14. $49^{-\frac{3}{2}}$ $\dfrac{1}{\left(\sqrt{49}\right)^3}$ $\dfrac{1}{7^3}$ $\dfrac{1}{343}$

15. $8^{\frac{5}{3}}$ $\left(\sqrt[3]{8}\right)^5$ 2^5 32

16. $64^{-\frac{7}{6}}$ $\dfrac{1}{\left(\sqrt[6]{64}\right)^7}$ $\dfrac{1}{2^7}$ $\dfrac{1}{128}$

17. $9^{\frac{3}{2}}$ $\left(\sqrt{9}\right)^3$ 3^3 27

18. $125^{\frac{2}{3}}$ $\left(\sqrt[3]{125}\right)^2$ 5^2 25

Solve for the variable.

19. $\sqrt[3]{5x-6} = 4$

$5x-6=64$

$5x=70$

$x=14$

20. $(3x+2)^{2/5} = 4$

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

$\sqrt[5]{3x+2} = 2$

$3x+2=32$

$3x=30$

$x=10$

21. $\frac{1}{\sqrt[4]{t^3}} = \frac{1}{8}$

$8 = \sqrt[4]{t^3}$

$2 = \sqrt[4]{t}$

$16=t$

22. $\sqrt[6]{m^5} = 3125$

$\sqrt[6]{m} = 5$

$m = 15625$

23. Consider the growth of 20 E. coli bacteria. The number of bacteria doubles every 6 hours.

a. Write a function, using a rational exponent, for the number of bacteria present after x hours.

$f(x) = 20(2)^{x/6}$

b. Rewrite the function using the properties of exponents, so that the exponent is an integer. What is the growth rate/percent of growth every hour?

$f(x) = 20(\sqrt[6]{2})^x$

$f(x) = 20(1.122)^x$

$r = .122$ or 12.2%

24. If there are originally 20 bacteria, at what rate/percent are they growing if the population doubles in 7 hours?

$40 = 20(1+r)^7$

$2 = (1+r)^7$

$1.10 = 1+r$

$r = .10$ or 10%

a. What about if the bacteria quadruples in 9 hours?

$80 = 20(1+r)^9$

$4 = (1+r)^9$

$1.17 = 1+r$

$r = .17$ or 17%

25. If there are originally 20 bacteria and they double each hour, how long will it take for the population to reach 160 bacteria? Solve the problem algebraically.

$160 = 20(2)^x$

$8 = 2^x$

$x = 3$ hrs

26. If there are originally 80 bacteria and they double each hour, how long will it take for the population to reach 1280 bacteria? Solve the problem algebraically.

$1280 = 80(2)^x$

$16 = 2^x$

$x = 4$ hrs.