Jakarta International School
8th Grade – AG1
Practice Test - Blue

Exponents, Radicals, and the Pythagorean Theorem

Name: SOLUTIONS

Date:

Score: $\frac{}{58}$

Goal 8: Apply Exponents, Radicals, and the Pythagorean Theorem

2 Points Per Problem Unless Stated Otherwise

1. Solve for x

A. $4^{-x} \cdot 4^3 = 4^{2x} \cdot 4^3$

$-x + 3 = 2x + 3$

$\boxed{x = 0}$

B. $2^x \cdot 5^x = 10^{20}$

$2^x \cdot 5^x = (5 \cdot 2)^{20}$

$\boxed{x = 20}$

C. $5^4 = \left(\frac{1}{25}\right)^x$

$5^4 = (5^{-2})^x \qquad -2x = 4 \qquad \boxed{x = -2}$

2. If $x \oplus y = (x^y)^x$, what is the units digit of $7 \oplus 5$?

$(7^5)^7 = 7^{35}$

Look for a pattern:

$7^1 = 7$
$7^2 = 49$
$7^3 = 343$
$7^4 = 2401$
$7^5 = 16807$
$7^6 = 117649$

Units digit pattern is $7, 9, 3, 1 ...$

so 7^{32} will end in 1
7^{33} will end in 7
7^{34} will end in 9

and 7^{35} will end in 3

3. Given that $2^2 + 2^2 = 2^x$ and $4^3 + 4^3 + 4^3 + 4^3 = 4^y$, what is the value of y^x?

$2 \cdot 2^2 = 2^x$
$2^3 = 2^x \quad x = 3$

$4 \cdot 4^3 = 4^y$
$4^4 = 4^y \quad y = 4$

$y^x = 4^3 = \boxed{64}$

4. One billion is 10^n divided by one-millionth. What is the value of n?

$10^9 = \frac{10^n}{10^{-6}} \rightarrow 10^n = 10^9 \cdot 10^{-6} \rightarrow 10^n = 10^3 \rightarrow \boxed{n = 3}$

5. There are about $5 \cdot 10^{19}$ cubic feet of water on the earth. A thimble the size of your thumb holds $5 \cdot 10^{-4}$ cubic feet of water. How many thimblefuls of water are on the earth?
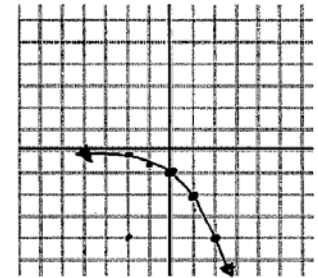
$\frac{5 \cdot 10^{19}}{5 \cdot 10^{-4}} = \boxed{10^{23} \text{ thimblefuls of water on the earth}}$

6. Simplify or evaluate the following expressions. Write answers in simplest form.

A. $(7^3 + 7^3 + 7^3 + 7^3 + 7^3 + 7^3 + 7^3)^{\frac{1}{2}}$

$(7 \cdot 7^3)^{\frac{1}{2}} = (7^4)^{\frac{1}{2}}$

$= 7^2 = \boxed{49}$

B. $(.15)^{-3}(.5)^5$

$\frac{100}{15} \cdot \frac{100}{15} \cdot \frac{100}{15} \cdot \frac{5}{10} \frac{5}{10} \frac{5}{10} \frac{5}{10} \frac{5}{10}$

$= \boxed{\dfrac{250}{27}}$

C. $\left(-1w^2t^3\right)^6\left(-1w^7t^{11}\right)^2$

$-1^6 w^{12} t^{18} \cdot -1^2 w^{14} t^{22} = \boxed{w^{26} t^{40}}$

7. Graph the following function: $y = -2^x$

x	y
-2	$-\frac{1}{4}$
-1	$-\frac{1}{2}$
0	-1
1	-2
2	-4

8. Between 1990 and 2000, the profits of a business decreased by approximately 10% each year. In 1990, the business' profit was $1 million.

A. Write an exponential model showing the business' profit P, t years after 1990.

$P = 1,000,000(.9)^t$

B. Use your model to determine the profit in 1993.

$P = 1,000,000\left(\frac{9}{10}\right)^3$

$P = 1,000,000 \cdot \frac{9}{10} \cdot \frac{9}{10} \cdot \frac{9}{10} = 1000 \cdot 729$

$= \boxed{729,000}$

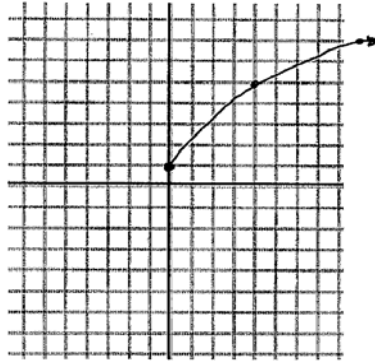9. Write an example of a quadratic equation in the form $x^2 = d$ for the following situations:

  a. An equation that has no real solution **(1 point)**

  $$x = -16$$

10. Sketch the graph. Then, identify its domain and range.
  $y = 2\sqrt{x} + 1$ **(3 points)**

x	y
0	1
4	5
9	7

Domain $x \geq 0$

Range $y \geq 1$

11. Evaluate or simplify the following expressions without using a calculator

A. $125^{\frac{1}{3}}$	B. $216^{\frac{4}{3}}$	C. $6^{\frac{1}{2}} \cdot 6^{\frac{3}{2}}$	D. $\sqrt[3]{y}(x^6 \cdot y^2)^{\frac{1}{3}}$
$\boxed{5}$	$\left(216^{\frac{1}{3}}\right)^4$ $6^4 = \boxed{1296}$	$6^2 = \boxed{36}$	$y^{\frac{1}{3}} \cdot x^2 \cdot y^{\frac{2}{3}} =$ $\boxed{x^2 y}$

E. $\sqrt{(5!)(5!)(6!).75}$	F. $\dfrac{\sqrt{1936 a^3 b^9}}{\sqrt{2}}$ $\dfrac{44 a b^4 \sqrt{ab}}{\sqrt{2}} \cdot \dfrac{\sqrt{2}}{\sqrt{2}}$
	$\begin{array}{c} 1936 \\ \wedge \\ 4 \quad 484 \\ \quad \wedge \\ 4 \quad 121 \\ \quad \wedge \\ 11 \quad 11 \\ \sqrt{1936} = 44 \end{array}$ $\dfrac{44 a b^4 \sqrt{2ab}}{2}$ $\boxed{22 a b^4 \sqrt{2ab}}$

12. Solve the equations. Write the solutions(s) as simplified as possible.

A. $8\left(x + \frac{1}{2}\right)^2 = 32$	B. $\sqrt{x} + 13 = 0$
$\sqrt{\left(x + \frac{1}{2}\right)^2} = \sqrt{4}$ $x + \frac{1}{2} = \pm 2$ $x = 2 - \frac{1}{2}$ or $-2 - \frac{1}{2}$ $\boxed{x = 1\frac{1}{2} \text{ or } -2\frac{1}{2}}$	$\left(\sqrt{x}\right)^2 = (-13)^2$ $x = 169$ check $\sqrt{169} + 13 = 0$ No! $\boxed{\text{No real solution}}$

13. What is the largest integer k such that $k^3 < 10^6$?

$$\left(k^3\right)^{\frac{1}{3}} < \left(10^6\right)^{\frac{1}{3}}$$

$$K < 10^2$$

largest integer is $\boxed{99}$

14. The hypotenuse of a right angled triangle is twice the length of one leg of the triangle. The length of the other leg is 12 cm. How many square centimeters are in the area of the right triangle? Express your answer in simplest radical form. **(4 points)**

$$x^2 + 12^2 = (2x)^2$$
$$x^2 + 144 = 4x^2$$
$$\frac{144}{3} = \frac{3x^2}{3}$$
$$48 = x^2$$

$$x = \sqrt{48}$$
$$x = 4\sqrt{3}$$
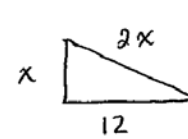
Area $= \frac{1}{2} \cdot 12 \cdot 4\sqrt{3} = \boxed{24\sqrt{3} \text{ square units}}$

15. **Cheap Sunglasses**: Gilbert was working on lighting for the school play and thought that he could make a cool pair of sunglasses by attaching some of the red filter film to his glasses. He did some research and learned that 20 percent of the light passing through the filter is absorbed. He also read that good sunglasses should absorb 80 percent of the incoming light, so he figured that if he put four layers of filter film on his glasses he'd be all set.

Calculate the percentage of light that passes through one layer of filter film, two layers of film, three layers of film, and four layers of film. Is Gilbert right?

P = percent of light that passes through. ; x = # of layers

$$P = 100(.8)^x$$

# of layers	Percent Passing through
0	100
1	80
2	64
3	51.2
4	40.96

No, he's wrong. 4 layers absorbs about 60%, not 80%

Write a formula that will calculate the percentage of light that will pass through n layers of filter film.

$$P = 100(.8)^x$$