4.7 Pre-AP Algebra 2
Radical Applications

Name _____
Date _____ Period _____

YOU MAY USE A CALCULATOR.
MUST SHOW WORK, INCLUDE UNITS AND ROUND TO 3 DECIMAL PLACES WHERE NECESSARY.

1. Lance is standing at the side of a road watching a cyclist go by. The distance 'd' in meters between Lance and the cyclist as a function of time 't' in seconds is given by $d=\sqrt{9+36t^2}$. Find the distance between Lance and the cyclist after 3 seconds.

$d=\sqrt{9+36(3)^2}$ = 18.248 m

2. A basketball has a volume of about 382 cubic inches. Find the radius of the basketball.

$\sqrt[3]{\frac{3V}{4\pi}}=\frac{\frac{4}{3}\pi r^3\left(\frac{3}{4}\right)}{\pi}$ $r=\sqrt[3]{\frac{3(V)}{4\pi}}$ = 4.501 in

3. The distance to the horizon 'd' miles from a satellite orbiting 'h' miles above Earth can be approximated by $d=\sqrt{8000h+h^2}$. What is the distance to the horizon if a satellite is orbiting 150 miles above the Earth?

$d=\sqrt{8000(150)+(150)^2}$ = 1105.067 miles

4. Cathy is building a cubic storage room. She wants the volume of the space to be 1728 cubic feet. What should the dimensions of the cube be?

$1728=s^3$

12 ft

5. Marcos has a rectangular box with dimensions 20 inches by 35 inches by 40 inches. He would like to replace it with a box in the shape of a cube but with the same volume. What should the length of a side of the cube be?

$28000=s^3$

$s=$ 30.366 in

6. Mr. Ingram's physics class is experimenting with pendulums. The class learned the formula $T=2\pi\sqrt{\frac{L}{g}}$ which relates the time T in seconds that it takes for a pendulum to swing back and forth based on gravity g (32 feet per second squared) and the length of the pendulum L in feet.

A) One group in the class made a 2-foot long pendulum. Use the formula to determine how long it will take for their pendulum to swing back and forth.

$T=2\pi\sqrt{\frac{2}{32}}$ = 1.571 sec

B) Another group decided they wanted to make a pendulum that took about 1.76 seconds to go back and forth. Approximately how long should their pendulum be?

$\left(\frac{T}{2\pi}\right)^2=\left(\sqrt{\frac{L}{g}}\right)^2$ $g\cdot\frac{L}{g}=\left(\frac{T}{2\pi}\right)^2\cdot g$ $L=g\left(\frac{T}{2\pi}\right)^2=32\left(\frac{1.76}{2\pi}\right)^2$

L = 2.511 ft

7. The area of an isosceles triangle with two sides of equal length 'a' and the other side length 'c', has area given by the formula $A = \frac{c}{4}\sqrt{4a^2 - c^2}$.

A) Find the area of an isosceles triangle with two sides of length 6 (a) inches and the other side length 7 (c) inches.

$A = \frac{7}{4}\sqrt{4(36) - 49} = 17.057 \text{ in}$

B) If the area of an isosceles triangle is 12 square inches and the 3rd side length is 6 inches, find the other two equal side lengths.

$\left(\frac{4A}{c}\right)^2 = \left(\sqrt{4a^2 - c^2}\right)^2$

$\frac{16A^2}{c^2} = 4a^2 - c^2$

$\frac{16A^2}{c^2} + c^2 = 4a^2$

$\sqrt{\frac{4A^2}{c^2} + \frac{c^2}{4}} = \sqrt{a^2}$

$a = \sqrt{\frac{4(144)}{36} + \frac{36}{4}}$

$a = 5 \text{ in}$

YOU MAY NOT USE A CALCULATOR FOR THIS SECTION.
MAKE SURE ALL ANSWERS ARE SIMPLIFIED COMPLETELY!!

8. The dimensions of a prism are $10x^4y^4$ inches, $\frac{1}{7}x^4y^3$ inches and $7x^{-4}y^2$ inches. Find the volume and give the units for the answer.

$V = 10x^4y^4\left(\frac{1}{7}x^4y^3\right)(7x^{-4}y^2)$

$V = 10x^4y^9 \text{ in}$

9. The dimensions of a prism are $8x^5y^{-3}$ inches, $\frac{1}{2}x^6y^{-5}$ inches and $3x^{-6}y^3$ inches. Find the volume and give the units for the answer. Simplify completely.

$8x^5y^{-3}\left(\frac{1}{2}x^6y^{-5}\right)(3x^{-6}y^3)$

$12x^5y^{-5} = \frac{12x^5}{y^5} \text{ in}$

10. Find the area and the perimeter of a rectangle with sides of $3x + \sqrt{3}$ and $2x + \sqrt{2}$

$A = (3x + \sqrt{3})(2x + \sqrt{2}) = 6x^2 + 3x\sqrt{2} + 2x\sqrt{3} + \sqrt{6}$

$P = 2(3x + \sqrt{3}) + 2(2x + \sqrt{2}) = 6x + 2\sqrt{3} + 4x + 2\sqrt{2}$

$= 10x + 2\sqrt{3} + 2\sqrt{2}$

11. Given a rectangle with an area of $6x^6y^4$ and a width of $2x^4y^3$ find the length.

$\frac{A}{w} = \frac{l \cdot w}{w}$

$l = \frac{A}{w} = \frac{6x^6y^4}{2x^4y^3} = 3x^2y$

12. The velocity V of an object in meters per second can be defined as $v = \sqrt{\frac{2K}{m}}$, where m is the mass of an object and K is the kinetic energy.

A) Find the velocity of an object with a mass of 11 grams and a kinetic energy of 550.

$V = \sqrt{\frac{2(550)}{11}} = \sqrt{\frac{1100}{11}}$ $\sqrt{100} =$ **10 m/sec.**

B) Find the kinetic energy of an object with velocity of 8 meters per second and a mass of 5 grams.

$mV^2 = \frac{2K}{m} \cdot m$ $K = \frac{mV^2}{2} = \frac{5(64)}{2} = \frac{320}{2} =$ **160**

$\frac{mV^2}{2} = \frac{2K}{2}$

C) Solve the given formula for K in terms of *v* and *m*:

$K = \frac{mV^2}{2}$

Solve the given formula for m in terms of *v* and *K* :

$mV^2 = 2K$

$m = \frac{2K}{V^2}$

13. Rearrange the formula as directed: $T = 2\pi\sqrt{\frac{L}{g}}$

Solve for L in terms of T and g:

$\left(\frac{T}{2\pi}\right)^2 = \frac{L}{g}$ $L = g\left(\frac{T}{(2\pi)}\right)^2$

Solve for g in terms of T and L:

$g = L\left(\frac{2\pi}{T}\right)^2$

14. A spherical balloon is being inflated faster and faster. The volume of the balloon as a function of time is $9\pi t^2$. What is the radius of the balloon as a function of time? Write your answer as a simplified expression using rational exponents.

$\left(\frac{3}{4}\right)\frac{9\pi t^2}{\pi} = \frac{4}{3}\frac{\pi r^3}{\pi}$ $\left(\frac{3}{4}\right)$

$\frac{27t^2}{4} = r^3$

$r = \sqrt[3]{\frac{27t^2}{4}}$

$V = \frac{4}{3}\pi r^3$

15. The formula $r = 2\sqrt{5L}$ is used by police to estimate the speed 'r' in miles per hour of a car if the length 'L' of the car's skid mark is measured in feet.

A) Estimate the speed of a car that leaves a skid mark 300 feet long.

$r = 2\sqrt{1500} = 2 \cdot 10\sqrt{15} =$ **$20\sqrt{15}$ m/hr**

B) Estimate the skid mark length if the car is travelling at 50 miles per hour.

$\frac{r}{2} = \sqrt{5L}$

$\frac{r^2}{4} = 5L$

$L = \frac{r^2}{20} = \frac{2500}{20} =$ **125ft**