Advanced Algebra - Radical Word Problems Name ______________________

1. A rectangle has the dimensions of $\sqrt{600} \times \sqrt{384}$ inches.

a. Find the perimeter ~~to the nearest hundredth.~~ in simplified radical form.

b. Find the area ~~to the nearest hundredth~~. in simplified radical form.

2. A rocket must attain escape velocity before it can escape the gravitational pull of a planet. The escape velocity " v " in km/s for a planet of mass, m, in kg and radius, r, in km is given by

$$v = (3.7 \times 10^{-10})\sqrt{\frac{m}{r}}$$

Find the Earth's escape velocity where $m = 5.98 \times 10^{24}$ and $r = 6376$ km.
(Round to the nearest hundredth.)

3. Much of the energy for a space mission is generated by solar cells attached to the outside of the spacecraft. An equilateral triangular cell measures 24 cm on a side.

Find the area of the solar cell by using Heron's formula, $A = \sqrt{s(s-a)(s-b)(s-c)}$.

A represents the area, s represents the semiperimeter, and a, b,& c represent the lengths of the sides of the triangle. The semiperimeter is one-half of the perimeter.
(Leave your answer in simplest radical form)

4. Each square centimeter of a solar cell generates $\sqrt{0.12}$ watts of electric power. How much energy can be delivered by one cell?
(Round your answer to the nearest tenth)

5. The primary radar system at La Guardia airport guides all aircraft within a radius of r_1 miles of the airport and covers an area of 90π mi^2. Secondary radar extends to a radius of r_2 miles and coves 1440π mi^2. Determine the difference in the radii of the circles.
(Leave your answer in simplest radical form.)

6. When two forces F_1 and F_2 pull at right angles to each other, the resultant or effective force, R, is given by the formula $R = \sqrt{F_1^2 + F_2^2}$

a. Solve the formula for F_1.

b. Suppose Leroy and Dana are helping Fred get is car out of a ditch. If 1000 lbs of force is needed and Leroy's truck is exerting a force of 800 lbs, how much force will Dana's car have to exert?
(Hint: R = 1000 lbs)

7. A driver whose eyes are "h" meters above the road is "d" meters from lettering on the highway. For maximum legibility, the letters should be

$$L = \frac{d^{9/4}}{400h}$$

where L represents length. A driver's eye height is 1.2m. The ideal length of the letters in a STOP message is 2.8m. Find the distance from the driver to the message for maximum legibility. (Hint: Which letter represents distance?)
(Round to the nearest hundredth.)

8. The period of a pendulum, T, in seconds is the length of time it takes for the pendulum to make one complete swing back and forth. The formula $T = 2\pi\sqrt{\frac{L}{32}}$ gives the period, T, for a pendulum of length, L, in feet.

a. Solve the formula for "L".

b. If you wanted to build a grandfather clock with a pendulum that swings back and forth once every 3 seconds, how long would you make the pendulum? (Round to the nearest hundredth.)

Advanced Algebra - Radical Word Problems Name Key

1. A rectangle has the dimensions of $\sqrt{600} \times \sqrt{384}$ inches.

a. Find the perimeter to the nearest hundredth.

$\sqrt{600} + \sqrt{384} + \sqrt{600} + \sqrt{384}$

$\sqrt{100 \cdot 6} + \sqrt{64 \cdot 6} + \sqrt{100 \cdot 6} + \sqrt{64 \cdot 6}$

$10\sqrt{6} + 8\sqrt{6} + 10\sqrt{6} + 8\sqrt{6}$

$\boxed{36\sqrt{6} \text{ in} \approx 88.18 \text{ in}}$

Exact Approx.

b. Find the area to the nearest hundredth.

$\sqrt{600} \cdot \sqrt{384} = \sqrt{230{,}400}$

$= \boxed{480 \text{ in}^2}$

exact ans.

2. A rocket must attain escape velocity before it can escape the gravitational pull of a planet. The escape velocity " v " in km/s for a planet of mass, m, in kg and radius, r, in km is given by

$$v = (3.7 \times 10^{-10})\sqrt{\frac{m}{r}}$$

Find the Earth's escape velocity where $m = 5.98 \times 10^{24}$ and $r = 6376$ km.

(Round to the nearest hundredth.)

$V = (3.7 \times 10^{-10}) \cdot \sqrt{\frac{5.98 \times 10^{24}}{6376}}$

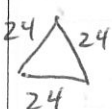
$\boxed{V = 11.33 \text{ km/s}}$

3. Much of the energy for a space mission is generated by solar cells attached to the outside of the spacecraft. An equilateral triangular cell measures 24 cm on a side.

Find the area of the solar cell by using Heron's formula, $A = \sqrt{s(s-a)(s-b)(s-c)}$.

A represents the area, s represents the semiperimeter, and a, b,& c represent the lengths of the sides of the triangle. The semiperimeter is one-half of the perimeter.

(Leave your answer in simplest radical form)



P=72

so

s=36

$A = \sqrt{36(36-24)(36-24)(36-24)}$

$A = \sqrt{36 \cdot 12 \cdot 12 \cdot 12}$

$A = \sqrt{62208}$

$A = \boxed{144\sqrt{3} \text{ cm}^2 \approx 249.42 \text{ cm}^2}$

exact approx.

4. Each square centimeter of a solar cell generates $\sqrt{0.12}$ watts of electric power. How much energy can be delivered by one cell?

(Round your answer to the nearest tenth)

$144\sqrt{3}\ \cancel{\text{cm}^2} \cdot \frac{\sqrt{.12} \text{ watts}}{\cancel{\text{cm}^2}}$

$144\sqrt{.36} \text{ watts} = 144 \cdot 0.6$

$\boxed{= 86.4 \text{ watts}}$

5. The primary radar system at La Guardia airport guides all aircraft within a radius of r_1 miles of the airport and covers an area of 90π mi^2. Secondary radar extends to a radius of r_2 miles and coves 1440π mi^2. Determine the difference in the radii of the circles.
(Leave your answer in simplest radical form.)

$A = \pi r_1^2$ $\qquad$ $A = \pi r_2^2$

$\frac{90\pi}{\pi} = \frac{\pi r_1^2}{\pi}$ $\qquad$ $\frac{1440\pi}{\pi} = \frac{\pi r_2^2}{\pi}$

$90 = r_1^2$ $\qquad$ $1440 = r_2^2$

$\sqrt{90} = r_1$ $\qquad$ $\sqrt{1440} = r_2$

$\sqrt{9 \cdot 10} = r_1$ $\qquad$ $\sqrt{144 \cdot 10} = r_2$

$3\sqrt{10} = r_1$ $\qquad$ $12\sqrt{10} = r_2$

$12\sqrt{10} - 3\sqrt{10} = \boxed{9\sqrt{10} \text{ mi} \approx 28.46 \text{ mi}}$

6. When two forces F_1 and F_2 pull at right angles to each other, the resultant or effective force, R, is given by the formula $R = \sqrt{F_1^2 + F_2^2}$

a. Solve the formula for F_1.

$R^2 = \left(\sqrt{F_1^2 + F_2^2}\right)^2$

$R^2 = F_1^2 + F_2^2$

$-F_2^2 \qquad -F_2^2$

$R^2 - F_2^2 = F_1^2$

$\boxed{F_1 = \sqrt{R^2 - F_2^2}}$

b. Suppose Leroy and Dana are helping Fred get is car out of a ditch. If 1000 lbs of force is needed and Leroy's truck is exerting a force of 800 lbs, how much force will Dana's car have to exert?
(Hint: R = 1000 lbs)

$F_1 = \sqrt{R^2 - F_2^2}$

$F_1 = \sqrt{1000^2 - 800^2}$

$\boxed{F_1 = 600 \text{ lbs}}$

7. A driver whose eyes are "h" meters above the road is "d" meters from lettering on the highway. For maximum legibility, the letters should be

$$L = \frac{d^{9/4}}{400h}$$

where L represents length. A driver's eye height is 1.2m. The ideal length of the letters in a STOP message is 2.8m. Find the distance from the driver to the message for maximum legibility.
(Hint: Which letter represents distance?)
(Round to the nearest hundredth.)

$2.8 = \frac{d^{9/4}}{400(1.2)}$

$2.8 = \frac{d^{9/4}}{480}$

$1344 = d^{9/4}$ $\qquad$ or $\qquad$ $1344 = d^{9/4}$

$1344 = \sqrt[4]{d^9}$ $\qquad$ $1344^{\wedge 4/9} = d$

$3.26 \times 10^{12} = d^9$

$\boxed{24.57 \text{ m} = d}$

8. The period of a pendulum, T, in seconds is the length of time it takes for the pendulum to make one complete swing back and forth. The formula $T = 2\pi\sqrt{\frac{L}{32}}$ gives the period, T, for a pendulum of length, L, in feet.

a. Solve the formula for "L".

$\frac{T}{2\pi} = \frac{2\pi \cdot \sqrt{L/32}}{2\pi}$

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

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

$\times 32 \qquad \times 32$

$\boxed{32\left(\frac{T}{2\pi}\right)^2 = L}$ or $\boxed{\frac{8T^2}{\pi^2} = L}$

b. If you wanted to build a grandfather clock with a pendulum that swings back and forth once every 3 seconds, how long would you make the pendulum? (Round to the nearest hundredth.)

$L = 32\left(\frac{3}{2\pi}\right)^2$

$\boxed{L \approx 7.30 \text{ ft}}$