

SOLUTIONS

3.3. SOLVING POWER EQUATIONS (AND ROOTS) – PRACTICE EXERCISES

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3.3 Solving power equations (and roots) – Practice exercises

ROOT FORMULA: The equation $C^n = v$ has solution $C = \sqrt[n]{v}$

1. A pizza of diameter D inches serves P people where

$$P = .015625D^2$$

Story also appears in 2.4 #1

- (a) Set up and solve an equation using the ROOT FORMULA to find the diameter of a personal pizza ($P = 1$). Answer to the nearest inch.

$$.015625 D^2 = 1$$

$$\frac{.015625 D^2}{.015625} = \frac{1}{.015625}$$

$$D^2 = 64$$

$$1 \div .015625 = 64$$

By the Root Formula

$$D^2 = 64$$

$$D = \sqrt{64} = \sqrt{64} = 8 \text{ inches}$$

check:

$$.015625 \times 8^2 = 1 \checkmark$$

OR do $2 \times \sqrt{64} =$
OR 2 MATH 5 64 =

- (b) Set up and solve an equation using the ROOT FORMULA to find the diameter of an extra large pizza to serve 6 people. Answer to the nearest $\frac{1}{10}$ inch.

$$.015625 D^2 = 6$$

$$\frac{.015625 D^2}{.015625} = \frac{6}{.015625}$$

$$D^2 = 384$$

$$D^2 = 384$$

$$D = \sqrt{384} = 19.5959... \approx 19.6 \text{ inches}$$

check:

$$.015625 \times 19.6^2 = 6.0025... \approx 6 \checkmark$$

2. The weight of a wood cube is a function of the length of the sides. A cube with sides each E inches long has weight W ounces according to the equation

$$W = .76E^3$$

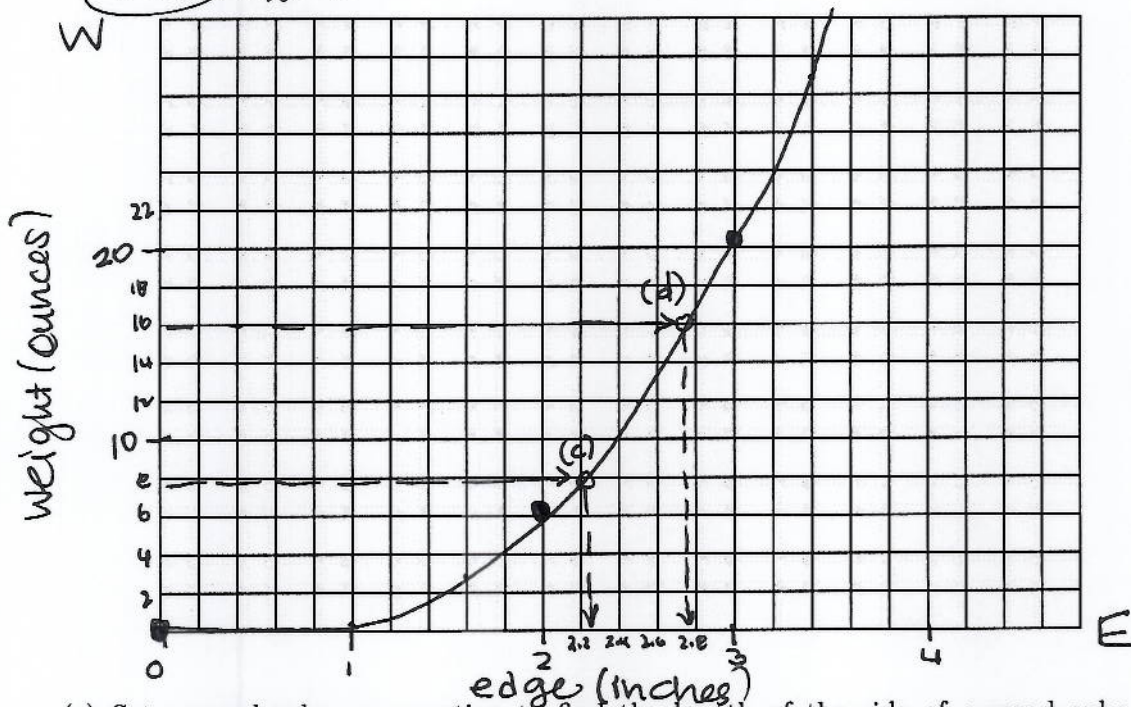
$$.76 \times 2^3 =$$

- (a) What is the weight of a cube with sides 2 inches long? 3 inches?

E	2	3
W	6.08	20.52

- (b) Draw a graph showing how the weight depends on the side length. Include

$$E = 0 \rightarrow W = 0$$



- (c) Set up and solve an equation to find the length of the side of a wood cube weighing 8 ounces. $\leftarrow W=8$

$$\frac{.76E^3}{.76} = \frac{8}{.76} = 8 \div .76 = 10.526...$$

$$\text{Root Formula} \Rightarrow E = \sqrt[3]{10.526...}$$

$$= 2.19158...$$

$$\approx 2.2 \text{ inches}$$

ANS
 $3 \times \sqrt[3]{10.526} =$
 or 3 MATHS 10.526 =

- (d) Repeat for 1 pound (that's 16 ounces).

$$W=16$$

$$\frac{.76E^3}{.76} = \frac{16}{.76} = 16 \div .76 = 21.052...$$

$$\text{Root Formula} \Rightarrow E = \sqrt[3]{21.052...} = 2.7612...$$

$$\approx 2.8 \text{ inches}$$

check:

$$.76 \times 2.2^3 = 8.09... \approx 8 \checkmark$$

check:

$$.76 \times 2.8^3 = 16.68... \approx 16 \checkmark$$

3. Suppose a car gas tank is designed to hold enough fuel to drive 350 miles. (That's fairly average.) That means the size tank, G gallons, is a function of the fuel efficiency, F miles per gallon (mpg) according to the equation

$$G = \frac{350}{F}$$

Story also appears in 2.4 #2

- (a) My Honda Accord's tank holds about 16 gallons. According to the equation, what is the corresponding fuel efficiency? Set up and solve the equation. Start solving by multiplying both sides by F . Note: you won't have to take a root.

$$G = 16$$

$$F \times (16) = \left(\frac{350}{F} \right) \times F$$

$$\frac{16F}{16} = \frac{350}{16} = 350 \div 16 = 21.875 \approx 21.9 \text{ mph}$$

check: $\frac{350}{21.9} = 350 \div 21.9 = 15.98... \approx 16 \checkmark$

- (b) My ex-husband's Honda Civic's tank holds only 13 gallons. According to the equation, what is the corresponding fuel efficiency? Set up and solve the equation.

$$G = 13$$

$$F \times (13) = \left(\frac{350}{F} \right) \times F$$

$$\frac{13F}{13} = \frac{350}{13} = 350 \div 13 = 26.92... \approx 26.9 \text{ mph}$$

check: $\frac{350}{26.9} = 350 \div 26.9 = 13.01... \approx 13 \checkmark$

4. Moose bought a commemorative football jersey for \$150 twelve years ago. Now he is planning to sell it and is interested in what the **effective return** (equivalent annual percent increase) on his investment might be for various prices. If J is the current value of the jersey and g is the annual growth factor, then

$$J = 150g^{12}$$

For each part, first solve for g using the ROOT FORMULA, then calculate $r = g - 1$. The effective return is r written as a percentage.

- (a) Find the effective return if the current value is \$290. $\leftarrow J = 290$

Root Formula \rightarrow

$$\frac{150g^{12}}{150} = \frac{290}{150} = 290 \div 150 = 1.93333\dots$$

$$g = \sqrt[12]{1.93333\dots} = 12^{\text{X}} \sqrt{\text{ANS}} = 1.056474\dots \approx 1.056$$

$$r = g - 1 \approx 1.056 - 1 = .056 = \boxed{5.6\%}$$

$\xrightarrow{\times 100\%}$

- (b) Find the effective return if the current value is \$350. $\leftarrow J = 350$

Root Formula \rightarrow

$$\frac{150g^{12}}{150} = \frac{350}{150} = 350 \div 150 = 2.3333\dots$$

$$g = \sqrt[12]{2.3333\dots} = 12^{\text{X}} \sqrt{\text{ANS}} = 1.07316\dots \approx 1.073$$

$$r = g - 1 \approx 1.073 - 1 = .073 = \boxed{7.3\%}$$

$\xrightarrow{\times 100\%}$

- (c) Find the effective return if the current value is \$400. $\leftarrow J = 400$

Root Formula \rightarrow

$$\frac{150g^{12}}{150} = \frac{400}{150} = 400 \div 150 = 2.6666\dots$$

$$g = \sqrt[12]{2.6666\dots} = 12^{\text{X}} \sqrt{\text{ANS}} = 1.08516\dots \approx 1.085$$

$$r = g - 1 \approx 1.085 - 1 = .085 = \boxed{8.5\%}$$

$\xrightarrow{\times 100\%}$