

## Polynomial Word Problems Practice and Homework

Name **ANSWER KEY**

1. At the ruins of Caesarea, archaeologists discovered a huge hydraulic concrete block with a volume of 945 cubic meters. The block's dimensions are  $x$  meters high by  $12x - 15$  meters long by  $12x - 21$  meters wide. What is the height of the block?



$$945 = x(12x - 15)(12x - 21)$$

Use the table of values to find  $x = 3$  meters  
or graph for intersection with  $y = 945$  or find zeros

2. You are designing a chocolate mold shaped like a hollow rectangular prism for a candy manufacturer. The mold must have a thickness of 1 cm in all dimensions. The mold's outer dimensions should also be in the ratio 1:3:6. What should the outer dimensions of the mold be if it is to hold 112 cubic centimeters of chocolate? **TRICKY! Students must subtract the 1 cm thickness from each dimension (2 cm total)**

$$(x - 2)(3x - 2)(6x - 2) = 112$$

Use the table of values to find  $x = 3$  cm

3. A manufacturer wants to build a rectangular stainless steel tank with a holding capacity of 670 gallons, or about 89.58 cubic feet. The tank's walls will be one half inch thick and about 6.42 cubic feet of steel will be used for the tank. The manufacturer wants the outer dimensions of the tank to be related as follows:

- The width should be 2 feet less than the length
- The height should be 8 feet more than the length



What should the outer dimensions of the tank be?

(HINT: Volume of steel = Volume outside - volume inside)

$$6.42 = x(x - 2)(x + 8) - 89.58 \quad x = 4 \text{ feet}$$

dimensions: 4 ft x 2 ft x 12 ft

4. From 1985 to 2003, the total attendance  $A$  (in thousands) at NCAA women's basketball games and the number  $T$  of NCAA women's basketball teams can be modeled by  $A = -1.95x^3 + 70.1x^2 - 188x + 2150$  and  $T = 14.8x + 725$  where  $x$  is the number of years since 1985. Compare and contrast the two functions. Find the attendance and number of teams for the year 1998. **1998 means  $x = 13$  Attendance: 7269 Teams: 917**

5. Suppose you have 250 cubic inches of clay with which to make a sculpture shaped as a rectangular prism. You want the height and width each to be 5 inches less than the length. What should the dimensions of the prism be if you want to use all of your clay?

$$250 = x(x - 5)^2 \quad x = 10 \text{ inches} \quad \text{dimensions: } 10 \text{ in} \times 5 \text{ in} \times 5 \text{ in}$$

6. The price  $p$  (in dollars) that a radio manufacturer is able to charge for a radio is given by  $p = 40 - 4x^2$  where  $x$  is the number of radios produced in millions. It costs the company \$15 to make a radio.

- a) Write an expression for the company's total revenue in terms of  $x$   
# of radios sold \* price charged  $x(40 - 4x^2) = 40x - 4x^3$
- b) Write a function for the company's profit  $P$  by subtracting the total cost to make  $x$  radios from the expression in part a  
revenue - cost per radio  $(40x - 4x^3) - 15x = -4x^3 + 25x$
- c) Currently the company produces 1.5 million radios and makes a profit of \$24,000,000. What lesser number of radios can the company produce to still make a profit? 1 million radios (\$21 mil) or 2 million radios (\$18 mil)

7. **CHALLENGE:** The profit  $P$  (in millions of dollars) for a DVD manufacturer can be modeled by  $P = -6x^3 + 72x$  where  $x$  is the number of DVDs produced (in millions). Show that 2 million DVDs is the only production level for the company that yields a profit of \$96,000,000.

Look at the table of values or the graph to see that a relative maximum occurs at  $x = 2$

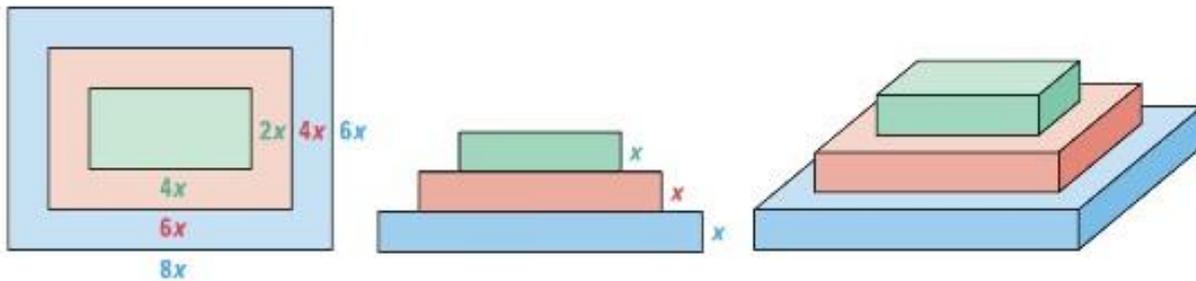
8. A platform shaped like a rectangular prism has dimensions  $(x - 2)$  feet by  $(3 - 2x)$  feet by  $(3x + 4)$  feet. Explain why the volume of the platform cannot be  $7/3$  cubic feet.

$$(x - 2)(3 - 2x)(3x + 4) = 7/3$$

The volume cannot be  $7/3$  because the maximum value of the polynomial is 1.158 at a value of  $x = 1.76$

## BONUS

**MULTI-STEP PROBLEM** A production crew is assembling a three-level platform inside a stadium for a performance. The platform has the dimensions shown in the diagrams, and has a total volume of 1250 cubic feet.

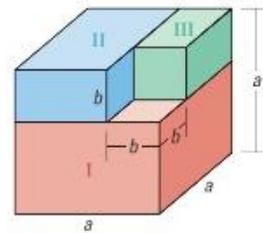


- Write Expressions** What is the volume, in terms of  $x$ , of each of the three levels of the platform?
- Write an Equation** Use what you know about the total volume to write an equation involving  $x$ .
- Solve** Solve the equation from part (b). Use your solution to calculate the dimensions of each of the three levels of the platform.

- Level one:  $V = x(8x)(6x) = 48x^3$   
 Level two:  $V = x(6x)(4x) = 24x^3$   
 Level three:  $V = x(4x)(2x) = 8x^3$
- Total volume:  $80x^3 = 1250$
- $x = 2.5$   
 Level one: 2.5 ft x 20 ft x 15 ft  
 Level two: 2.5 ft x 15 ft x 10 ft  
 Level three: 2.5 ft x 10 ft x 5 ft

**CHALLENGE** Use the diagram to complete parts (a)–(c).

- Explain why  $a^3 - b^3$  is equal to the sum of the volumes of solid I, solid II, and solid III.
- Write an algebraic expression for the volume of each of the three solids. Leave your expressions in factored form.



- Large cube has volume  $a^3$  and small missing cube has volume  $b^3$
- Solid I:  $a(a)(a - b) = a^3 - a^2b$   
 Solid II:  $a(b)(a - b) = a^2b - ab^2$   
 Solid III:  $b(b)(a - b) = ab^2 - b^3$