Warm-up 1

A car dealership's profit can be modeled by the function $P(x) = x^3 + 2x^2 + 400x - 400$, where x is the number of cars sold. How many cars will they have to sell to make $40,000 in profit?

Find the solution: 29.87, so between 29 and 30 cars

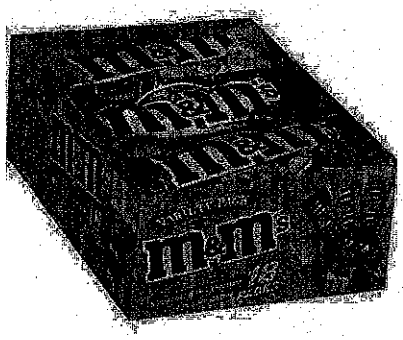
Explain two ways that your calculator could help you solve this problem.

1) Set the equation equal to zero, find the x intercepts $x^3+2x^2+400x-40400=0$

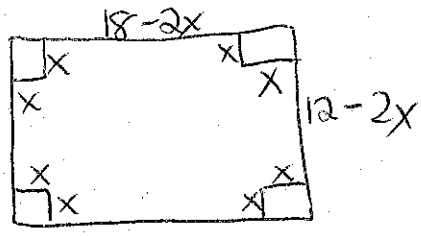
2) $Y_1 = x^3+2x^2+400x-400$ $Y_2 = 40{,}000$ Find the intersection

Warm-up 2

Mars Inc. is going to make an open-top box by cutting equal squares from the four corners of a 12 inch by 18 inch sheet of cardboard and folding up the sides.



Sketch a diagram to represent this problem.



Write a polynomial to represent the area of the base of the box:

Area = length · width

$= (18-2x)(12-2x) = \boxed{216-60x+4x^2}$

Write a polynomial to represent the volume of the box:

Volume = length · width · height

$= (4x^2-60x+216)(x) = 4x^3-60x^2+216x$

What size square should Joe cut out to yield the maximum possible volume?

x = 2.35 in Max Volume = 228.16 in^3

Square would be 2.35 x 2.35

Cubic Polynomial - Application

Homework/Classwork

1. **You are designing a swimming pool with a volume of 4800 ft^3. The width of the pool should be 7 feet more than the depth. The length should be 32 feet more than the depth. What should the dimensions of this rectangular swimming pool be?**

$L = D+32$
$W = D+7$
$D = D$

$Vol = \ell \cdot w \cdot h$
$4800 = (D+32)(D+7)(D)$
$4800 = (D^2+39D+224)(D)$
$4800 = D^3+39D^2+224D$

$D=8 \quad W=15 \quad L=40$

2. **The height of a box that Caleb is shipping is 3 inches less than the width of the box. The length is 2 inches more than twice the width. The volume of the box is 1540 in^3. What are the dimensions of the box?**

$w = w$
$h = w-3$
$\ell = 2w+2$

$w(w-3)(2w+2) = 1540$
$(w^2-3w)(2w+2) = 1540$
$2w^3-4w^2-6w = 1540$

$w = 10$
$h = 7$
$\ell = 22$

3. **A rectangular shipping container has a volume of 2500 cm^3. The container is 4 times as wide as it is long, and 5cm taller than it is wide. What are the dimensions of the container?**

$\ell = \ell$
$w = 4\ell$
$h = 4\ell+5$

$(\ell)(4\ell)(4\ell+5) = 2500$
$4\ell^2(4\ell+5) = 2500$
$16\ell^3+20\ell^2 = 2500$

$\ell = 5$
$w = 20$
$h = 25$

4. **Joe is going to make an open-top box by cutting equal squares from the four corners of an 11 inch by 14 inch sheet of cardboard and folding up the sides.**

Sketch a diagram to represent this problem.

Write a polynomial to represent the area of the base of the box:

$Area = (11-2x)(14-2x) = 4x^2-50x+154$

Write a polynomial to represent the volume of the box:

$Volume = (4x^2-50x+154)(x) = 4x^3-50x^2+154x$

What size square should Joe cut out to yield the maximum possible volume?

Squares that are 2.04×2.04 give a max volume of $140.03\ in^3$