Pre-Calculus 12 Solving Problems with Polynomials

Ex. 1.) A container with the shape of a rectangular prism has a volume, in ft^3, represented by $V = x^3 + 7x^2 - 28x + 20$. Determine the factors that represent possible dimensions, in terms of x, of the container.

poss "a" values $\pm 1, \pm 2, \pm 4, \pm 5, \pm 10, \pm 20$

$V(1) = 1^3 + 7(1)^2 - 28(1) + 20$

$= 0$ $\therefore x-1$ is a factor

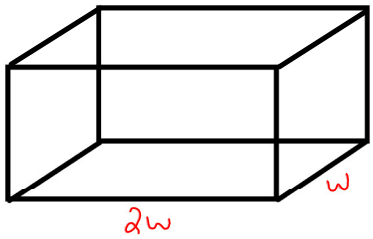
1	1	7	-28	20
	↓	1	8	-20
	1	8	-20	0

$V = (x-1)(x^2 + 8x - 20)$

$V = (x-1)(x+10)(x-2)$

possible dimensions

Ex. 2.) A box is constructed such that the length is twice the width and the height is 2 in longer than the width. If the volume of the box is 90 in^3, determine the dimensions of the box.



$l = 2w$

$h = w + 2$

$V = lwh$

$90 = w(2w)(w+2)$

$90 = 2w^3 + 4w^2$

$0 = 2w^3 + 4w^2 - 90$

$\div 2$

$0 = w^3 + 2w^2 - 45$

poss "a" value: $\pm 1, \pm 3, \pm 5, \pm 9, \pm 15, \pm 45$

$V(3) = 3^3 + 2(3)^2 - 45$

$= 0$

3	1	2	0	-45
	↓	3	15	45
	1	5	15	0

$V = (w-3)(w^2 + 5w + 15)$

$0 = (w-3)(w^2 + 5w + 15)$ ← does not factor

$w = 3$

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$w = \frac{-5 \pm \sqrt{25 - 4(1)(15)}}{2(1)}$

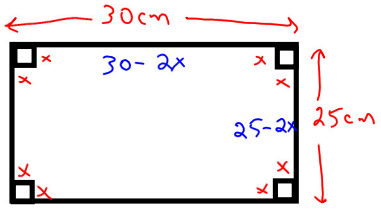
$w = \frac{-5 \pm \sqrt{-35}}{2}$ ← no sol'n here

$\therefore$ width is 3 in

length is 6 in $2(3)$

height is 5 in $3+2$

Ex. 3) A piece of cardboard 30 cm long and 25 cm wide is used to make an open box. Equal squares of side length x cm are cut from the corners and the sides are folded up. Determine the length of the square that must be cut from each corner if the volume of the box is 1496 cm^3.



$V = x(30-2x)(25-2x)$

$1496 = x(750 - 60x - 50x + 4x^2)$ (-110x)

$0 = 750x - 110x^2 + 4x^3 - 1496$

$0 = 4x^3 - 110x^2 + 750x - 1496$

$0 = 2x^3 - 55x^2 + 375x - 748$

$V(4) = 2(4)^3 - 55(4)^2 + 375(4) - 748$

$= 0$

4	2	-55	375	-748
	↓	8	-188	-748
	2	-47	187	0

$(x-4)(2x^2 - 47x + 187) = 0$

$x = 4$ cm $\quad x = \dfrac{47 \pm \sqrt{47^2 - 4(2)(187)}}{2(2)}$

$x = \dfrac{47 \pm \sqrt{713}}{4}$

$x = 18.426$

$x < 12.5$

$x = 5.074$ cm

length of square is either 4 cm or 5.074 cm

Ex. 4) The product of four consecutive integers is $x^4 + 6x^3 + 11x^2 + 6x$ where x is one of the integers. Determine possible expressions for the other three integers.

$x^4 + 6x^3 + 11x^2 + 6x$

GCF $x(x^3 + 6x^2 + 11x + 6)$ then factor this

$(-1)^3 + 6(-1)^2 + 11(-1) + 6 = 0$

$\therefore x+1$ is a factor

-1	1	6	11	6
	↓	-1	-5	-6
	1	5	6	0

$x(x+1)(x^2 + 5x + 6)$

$x(x+1)(x+2)(x+3)$

other 3 integers

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Review pg. 104