2.7: Write a polynomial given zeroes

Ex 1) Write a polynomial in standard form with zeroes $x=4$ m2, $x=-3$ m1

$(x-4)=0 \qquad (x+3)=0$

$(x-4)^2(x+3)$ ← factored form

$(x-4)(x-4)(x+3)$

$(x^2-4x-4x+16)(x+3)$

$(x^2-8x+16)(x+3)$

$x^3+3x^2-8x^2-24x+16x+48$

$\boxed{x^3+(-5x^2)-8x+48}$ ← standard form

Ex 2) Write a polynomial in standard form w/ zeroes

$x=\frac{2}{3}$ m1, $x=3-2i$ m1, $x=3+2i$ m1

$(x-\frac{2}{3}=0)3 \qquad (x-3+2i)=0 \qquad (x-3-2i)=0$

$(3x-2)=0$

$(3x-2)(x-3+2i)(x-3-2i)$

$(3x-2)(x^2-3x-2xi-3x+9+6i+2xi-6i+4i^2)$

$(3x-2)(x^2-6x+13)$

$3x^3-18x^2+39x-2x^2+12x-26$

$\boxed{3x^3-20x^2+51x-26}$

GUIDED NOTES: Polynomial Applications

EX1. For 1985 through 1996, the number, C (in millions), of videos rented each year in the United States can be modeled by $C = 0.053\left(t^3 + 2t^2 + 33t + 500\right)$, where $t = 0$ represents 1990. Using this model, estimate the number of videos rented in the United States in 1994.

$1994 - 1990 = 4t$

$C = 0.053(4^3 + 2(4)^2 + 33(4) + 500)$

$C = 38.584$ million videos

EX2. The profit P (in millions of dollars) for a manufacturer of MP3 players can be modeled by $P = -4x^3 + 12x^2 + 16x$, where x is the number of MP3 players produced (in millions). Currently, the company produces 3 million MP3 players and makes a profit of \$48,000,000. What lesser number of MP3 players could the company produce and still make the same profit? 48

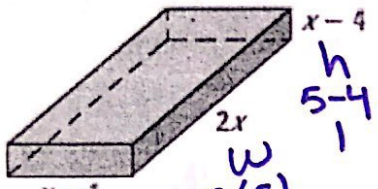
$48 = -4x^3 + 12x^2 + 16x$

$-48 \qquad -48$

$0 = -4x^3 + 12x^2 + 16x - 48$

2 million MP3 players

EX3. Given that the volume of the box is 40 in^3, determine the dimensions of the box.



$x - 4$: h, $5 - 4$, 1

$2x$: w, $2(5)$, 10

$x - 1$: l, $5 - 1$, 4

$V = lwh$

$40 = (x-1)(2x)(x-4)$

$-40 \qquad -40$

$0 = (x-1)(2x)(x-4) - 40$

$x = 5$

4in × 10in × 1in

EX4. A rectangular pool has a length of $x^2 + 9x + 3$ feet and a width of $4x - 2$ feet. Determine the area of the pool.

$(4x-2)(x^2+9x+3)$

$4x^3 + 36x^2 + 12x - 2x^2 - 18x - 6$

$4x^3 + 34x^2 - 6x - 6 \text{ ft}^2$

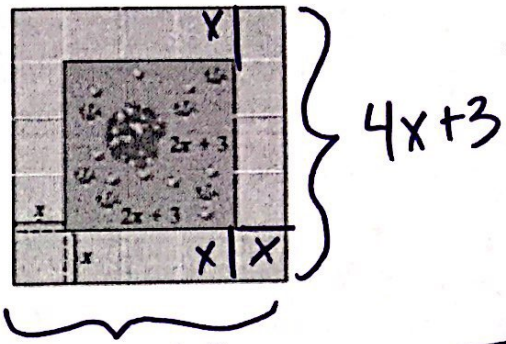
EX5. A rectangular Tyrannosaurus Rex paddock has an area of $x^3 + x^2 - 11x + 4$ square meters, and a width of $x + 4$ meters. Find its length.

$x+4=0$, $x=-4$

-4 | 1 | 1 | −11 | 4
↓ | −4 | 12 | −4
1 | −3 | 1 | 0

$x^2 - 3x + 1$ m

EX6. Find the area of the garden and the walkway.



garden: $(2x+3)(2x+3)$

$4x^2 + 6x + 6x + 9$

$4x^2 + 12x + 9$ units^2

walkway: $(G+w) = (4x+3)(4x+3)$

$= 16x^2 + 12x + 12x + 9$

$= 16x^2 + 24x + 9 - (4x^2 + 12x + 9) =$

$12x^2 + 12x$ units^2 walkway

EX7. You are designing a rectangular swimming pool that is to be set into the ground. The width of the swimming pool is 5 feet more than the depth, the length is 35 feet more than the depth. The pool holds 2000 cubic feet of water. What are the dimensions of the pool?

$V = lwh$

$l: x+35$

$w: x+5$

$h: x$

$2000 = x(x+35)(x+5)$

$x = 5$

40 ft x 10ft x 5ft

EX8. For the 12 years that a grocery store has been open, its annual revenue R (in millions of dollars) can be modeled by the function $R = 0.0001(-t^4 + 12t^3 - 77t^2 + 600t + 13650$ where t is the number of years since the store opened. In which year(s) was the revenue \$1.5 million?

$1.5 = 0.0001(-t^4 + 12t^3 - 77t^2 + 600t + 13650)$

$t = 3$

3 years after opening