5.2 Practice – Poly Division and Factor Theorems Name: _____

Pre-Calculus

For 1-3, use long division to divide the polynomials.

1. $(2x^2 - 7x + 4) \div (x - 2)$

$= 2x - 3 + \frac{-2}{x-2}$

$2x - 3 + \frac{-2}{x-2}$

$x-2 \overline{)2x^2 - 7x + 4}$

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

$-3x + 4$

$+(+3x + -6)$

-2

2. $(y^2 - 9) \div (y + 1)$

$= y - 1 + \frac{-8}{y+1}$

$y - 1 + \frac{-8}{y+1}$

$y+1 \overline{)y^2 + 0y - 9}$

$+(-y^2 + -1y)$

$-y - 9$

$+(+y + 1)$

-8

3. $(9x^5 - 3x^3 + 21x^2 - 2x + 4) \div (3x^2 + 1)$

$= 3x^3 - 2x + 7 + \frac{-3}{3x^2+1}$

$3x^3 - 2x + 7 + \frac{-3}{3x^2+1}$

$3x^2+1 \overline{)9x^5 + 0x^4 - 3x^3 + 21x^2 - 2x + 4}$

$+(-9x^5 \quad +3x^3)$

$-6x^3 + 21x^2 - 2x + 4$

$+(+6x^3 \quad +2x)$

$21x^2 + 4$

$+(+21x^2 \quad +7)$

-3

For 4-6, use synthetic division to divide the polynomials

4. $(x^2 + 3x - 3) \div (x - 3)$

$= x + 6 + \frac{15}{x-3}$

$3 \mid 1 \quad 3 \quad -3$

$\quad\quad 3 \quad 18$

$1 \quad 6 \quad \boxed{15}$

$(x-(-1))$

5. $(7x^6 + 50x^3 + 20x) \div (x + 2)$

$(x-(-2))$

$= 7x^5 - 14x^4 + 28x^3 - 6x^2 + 12x - 4 + \frac{8}{x+2}$

$-2 \mid 7 \quad 0 \quad 0 \quad 50 \quad 0 \quad 20 \quad 0$

$\quad\quad -14 \quad 28 \quad -56 \quad 12 \quad -24 \quad 8$

$7 \quad -14 \quad 28 \quad -6 \quad 12 \quad -4 \quad \boxed{R8}$

6. $(3x^4 - 4x^2 + 1) \div (x + 1)$

$(x-(-1))$

$= 3x^3 - 3x^2 - x + 1$

$-1 \mid 3 \quad 0 \quad -4 \quad 0 \quad 1$

$\quad\quad -3 \quad 3 \quad 1 \quad -1$

$3 \quad -3 \quad -1 \quad 1 \quad \boxed{0}$

7. If $(x + 1)$ is a factor of $2x^5 + 2x^4 - 5x^3 - 5x^2 - 3x - 3$, what are all the factors of $f(x)$.

$-1 \mid 2 \quad 2 \quad -5 \quad -5 \quad -3 \quad -3$

$\quad\quad -2 \quad 0 \quad 5 \quad 0 \quad 3$

$2 \quad 0 \quad -5 \quad 0 \quad -3 \quad \boxed{0}$

$2x^5 + 2x^4 - 5x^3 - 5x^2 - 3x - 3$

$= (x+1)(2x^4 - 5x^2 - 3)$

$= (x+1)[2x^4 - 6x^2 + x^2 - 3]$

$= (x+1)[2x^2(x^2-3) + 1(x^2-3)]$

$= (x+1)(x^2-3)(2x^2+1)$ ← Answer

8. Is $(x - 11)$ a factor of $(3x^4 - 33x^3 - 17x^2 + 187x - 11)$? I'm not quite sure. Lemme check.

$11 \mid 3 \quad -33 \quad -17 \quad 187 \quad -11$

$\quad\quad 33 \quad 0 \quad -187 \quad 0$

$3 \quad 0 \quad -17 \quad 0 \quad \boxed{-11}$

NO, $(x-11)$ is not a factor.

$3\left(x+\frac{5}{3}\right)=3\left(x-\frac{-5}{3}\right)$

9. If $(3x+5)$ is a factor of $6x^3+31x^2+23x-20$, what are all the factors of $f(x)$.

① $3x+5 \overline{)\,6x^3+31x^2+23x-20}$

$2x^2+7x-4$

$+(-6x^3+10x^2)$

$21x^2+23x-20$

$+(-21x^2+35x)$

$-12x-20$

$+(+12x+20)$

0

② FACTOR

$2x^2+7x-4$

$=2x^2-x+8x-4$

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

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

③ $6x^3+31x^2+23x-20=(3x+5)(2x-1)(x+4)$

10. Is $(n+1)$ a factor of $(6n^3+6n^2)$?

$(n-\,-1)$

$f(n)=6n^3+6n^2$

$f(-1)=6(-1)^3+6(-1)^2$

$=6(-1)+6(1)$

$=-6+6$

$f(-1)=0$

∴ Since $f(-1)=0$, $(x+1)$ is a factor of $6n^3+6n^2$

For 11-14, a zero of the function is given. Find ALL the zeros of the function.

11. $f(x)=4x^3-25x^2-154x+40;\ f(10)=0$

①

10	4	−25	−154	40
		40	150	−40
	4	15	−4	R0

② FACTOR

$4x^2+15x-4=0$

$4x^2-x+16x-4=0$

$x(4x-1)+4(4x-1)=0$

$(4x-1)(x+4)=0$

$4x-1=0 \quad x+4=0$

$4x=1 \quad x=-4$

$x=\frac{1}{4}$

③ $x=-4,\frac{1}{4},10$

12. $f(x)=3x^3+34x^2+72x-64;\ f(-4)=0$

①

−4	3	34	72	−64
		−12	−88	64
	3	22	−16	R0

② FACTOR

$3x^2+22x-16=0$

$3x^2-2x+24x-16=0$

$x(3x-2)+8(3x-2)=0$

$(3x-2)(x+8)=0$

$3x-2=0 \quad x+8=0$

$3x=2 \quad x=-8$

$x=\frac{2}{3}$

③ $x=-8,-4,\frac{2}{3}$

13. $f(x)=x^5+2x^4+7x^3+14x^2+6x+12$

$f(-2)=0$

①

−2	1	2	7	14	6	12
		−2	0	−14	0	−12
	1	0	7	0	6	R0

② FACTOR

$x^4+7x^2+6=0$

$x^4+6x^2+x^2+6=0$

$x^2(x^2+6)+1(x^2+6)=0$

$(x^2+6)(x^2+1)=0$

$x^2+6=0 \quad x^2+1=0$

$x^2=-6 \quad x^2=-1$

$x=\pm i\sqrt{6} \quad x=\pm i$

③ $x=\pm i\sqrt{6},\pm i,-2$

14. $f(x)=x^3-125;\ f(5)=0$

①

5	1	0	0	−125
		5	25	125
	1	5	25	R0

② FACTOR DOESN'T

$x^2+5x+25=0$

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

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

$=\frac{-5\pm\sqrt{25-100}}{2}$

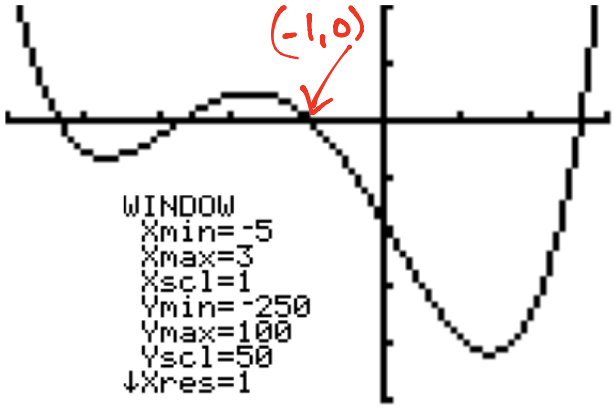
$=\frac{-5\pm\sqrt{-75}}{2}$

$x=\frac{-5\pm 5i\sqrt{3}}{2}$

③ $x=5,\frac{-5\pm 5i\sqrt{3}}{2}$

For 15-16, use the graph of the function to determine at least one zero, then find the exact values of all the zeros using the Factor Theorem.

15. $f(x) = 3x^4 + 16x^3 - 8x^2 - 112x - 91$



①
$$\begin{array}{c|cccc} -1 & 3 & 16 & -8 & -112 & -91 \\ & & -3 & -13 & 21 & 91 \\ \hline & 3 & 13 & -21 & -91 & R\,0 \end{array}$$

② FACTOR

$3x^3 + 13x^2 - 21x - 91 = 0$

$x^2(3x+13) - 7(3x+13) = 0$

$(x^2-7)(3x+13) = 0$

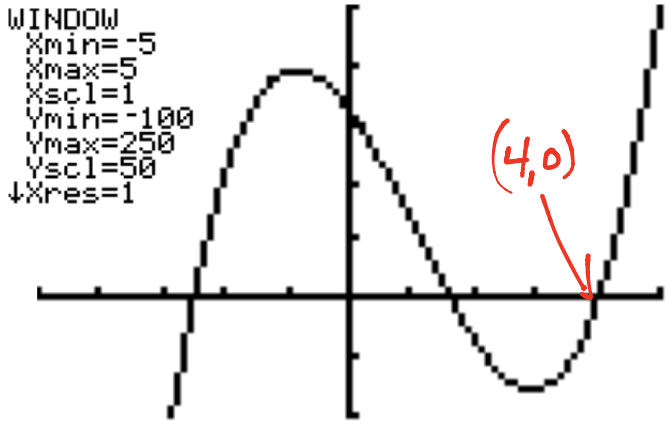
$x^2 - 7 = 0$ | $3x + 13 = 0$

$x^2 = 7$ | $3x = -13$

$x = \pm\sqrt{7}$ | $x = -\frac{13}{3}$

③ $x = -\frac{13}{3}, \pm\sqrt{7}, -1$

16. $f(x) = 10x^3 - 31x^2 - 76x + 160$



①
$$\begin{array}{c|cccc} 4 & 10 & -31 & -76 & 160 \\ & & 40 & 36 & -160 \\ \hline & 10 & 9 & -40 & R\,0 \end{array}$$

② FACTOR

$10x^2 + 9x - 40 = 0$

$10x^2 - 16x + 25x - 40 = 0$

$2x(5x-8) + 5(5x-8) = 0$

$(5x-8)(2x+5) = 0$

$5x - 8 = 0$ | $2x + 5 = 0$

$5x = 8$ | $2x = -5$

$x = \frac{8}{5}$ | $x = -\frac{5}{2}$

③ $x = -\frac{5}{2}, \frac{8}{5}, 4$

For 17-20, one zero is given of $f(x)$. List one other zero.

17. $13 - 25i$	18. $10i$	19. $3i + 1$	20. $\sqrt{7} + 14i$
$13 + 25i$	$-10i$	$-3i + 1$	$\sqrt{7} - 14i$