**Sections 2.3 through 2.5 - I.C.E.** **Name:** KEY

## Section 2.3

Divide using long division

1. $\left(6x^3-16x^2+17x-6\right)\div\left(3x-2\right)$

$$\begin{array}{r} 2x^2-4x+3 \\ 3x-2 \overline{\big)\, 6x^3-16x^2+17x-6} \\ -(6x^3-4x^2) \\ \hline -12x^2+17x \\ -(-12x^2+8x) \\ \hline 9x-6 \\ 9x-6 \\ \hline 0 \end{array}$$

Using synthetic division, express the function in the form $f(x)=(x-k)q(x)+r$ for the given value and demonstrate that $f(k)=r$

2. $f(x)=x^3-5x^2-11x+8;\quad k=-2$

$$\begin{array}{r|rrrr} -2 & 1 & -5 & -11 & 8 \\ & & -2 & 14 & -6 \\ \hline & 1 & -7 & 3 & 2 \end{array}$$

$f(x)=(x+2)(x^2-7x+3)+\frac{2}{x+2}$

$f(-2)=2$

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Use synthetic division to find each function value. Verify your answer by substitution.

3. $g(x) = x^6 - 4x^4 + 3x^2 + 2$

a. $g(2) = 14$

$$\begin{array}{r|rrrrrrr} 2 & 1 & 0 & -4 & 0 & 3 & 0 & 2 \\ & & 2 & 4 & 0 & 0 & 6 & 12 \\ \hline & 1 & 2 & 0 & 0 & 3 & 6 & 14 \end{array}$$

$g(2) = 2^6 - 4(2)^4 + 3(2^2) + 2 =$
$= 64 - 4(16) + 3 \cdot 4 + 2 = 14$

b. $g(-4) = 3122$

$$\begin{array}{r|rrrrrrr} -4 & 1 & 0 & -4 & 0 & 3 & 0 & 2 \\ & & -4 & 16 & -48 & +192 & \cancel{-780} & 3120 \\ \hline & 1 & -4 & 12 & -48 & 195 & -780 & 3122 \end{array}$$

$g(-4) = (-4)^6 - 4(-4)^4 + 3(-4)^2 + 2$
$= 4096 - 4 \cdot 256 + 3 \cdot 16 + 2$
$= 4096 - 1024 + 48 + 2 = 3122$

For #4 & #5, you are given one of the zeros of the polynomial function. Use synthetic division to verify and then use the result to factor the polynomial completely. List all real zeros of the function.

4. $f(x) = x^3 - 28x - 48 = 0$. One zero is $x = -4$

$$\begin{array}{r|rrrr} -4 & 1 & 0 & -28 & -48 \\ & & -4 & 16 & 48 \\ \hline & 1 & -4 & -12 & 0 \end{array}$$

$f(x) = (x+4)(x^2 - 4x - 12) = (x+4)(x-6)(x+2)$

Zeros: $-4, 6, -2$

5. $g(x) = x^3 - 4x^2 - 2x + 8$. One zero is $x = 4$.

$$\begin{array}{r|rrrr} 4 & 1 & -4 & -2 & 8 \\ & & 4 & 0 & -8 \\ \hline & 1 & 0 & -2 & 0 \end{array}$$

$f(x) = (x-4)(x^2 - 2)$

Zeros: $4, \pm\sqrt{2}$

## Section 2.4

Find numbers a and b such that the equation is true.

6. $(a-1)+(b+3)i=5+8i$

$a-1=5 \qquad b+3=8$

$\boxed{a=6 \qquad b=5}$

Write the complex numbers in terms of i and perform the operation and write the result in standard form.

7. $(-2+\sqrt{-8})+(5-\sqrt{-50})$

$=(-2+2i\sqrt{2})+(5-5i\sqrt{2})$

$\boxed{=3-3i\sqrt{2}}$

8. $(8-3i)(5+2i)$

$=40-15i+16i-6i^2$

$=40+i-6(-1)$

$\boxed{=46+i}$

9. $(4+7i)^2$

$=(4+7i)(4+7i)$

$=16+28i+28i+49i^2$

$=16+56i-49 = \boxed{-33+56i}$

Write the quotient in standard form.

10. $\frac{6-i}{3+2i}\left(\frac{3-2i}{3-2i}\right)=\frac{18-3i-12i+2i^2}{9-4i^2}=\frac{18-15i-2}{9+4}=\boxed{\frac{16-15i}{13}}$

Use the quadratic formula to solve the quadratic equation.

11. $9x^2-6x+37=0$

$\frac{-(-6)\pm\sqrt{(-6)^2-4(9)(37)}}{2(9)}=\frac{6\pm\sqrt{36-1332}}{18}$

$=\frac{1}{3}\pm\frac{i\sqrt{1296}}{18}=\frac{1}{3}\pm\frac{36i}{18}=\boxed{\frac{1}{3}\pm 2i}$

## Section 2.5

Use the Rational Zero Theorem to give a listing of all *possible* rational zeros.

12. $f(x) = 4x^5 - 8x^4 - 5x^3 + 10x^2 + x - 2$

$p = \pm 2, \pm 1$

$q = \pm 4, \pm 2, \pm 1$

$\frac{p}{q} = \boxed{\pm \frac{1}{2}, \pm 1, \pm 2, \pm \frac{1}{4}}$

One of the zeros of this function is 5. Use synthetic division and then use the remaining polynomial to factor $f(x)$ completely.

13. $f(x) = 2x^3 - 5x^2 - 22x - 15$

$$\begin{array}{r|rrrr} 5 & 2 & -5 & -22 & -15 \\ & & 10 & 25 & 15 \\ \hline & 2 & 5 & 3 & 0 \end{array}$$

$f(x) = (x-5)(2x^2+5x+3)$

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

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Find all the zeros of the following function

14. $f(x)=3x^4+7x^3-19x^2+5x+4$

$p = \pm 4, \pm 2, \pm 1$
$q = \pm 3, \pm 1$

$\frac{p}{q} = \pm 4, \pm 2, \pm 1, \pm \frac{4}{3}, \pm \frac{2}{3}, \pm \frac{1}{3}$

$$\begin{array}{r|rrrrr} -4 & 3 & 7 & -19 & 5 & 4 \\ & & -12 & 20 & -4 & -4 \\ \hline & 3 & -5 & 1 & 1 & 0 \end{array}$$

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

$$\begin{array}{r|rrrr} 1 & 3 & -5 & 1 & 1 \\ & & 3 & -2 & -1 \\ \hline & 3 & -2 & -1 & 0 \end{array}$$

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

$(x+4)(x-1)(3x+1)(x-1)$

zeros: $-4, 1, -\frac{1}{3}$

↑

multiplicity 2