1

CP Precalculus Name______________________________

2-3: Polynomial Long Division

Date________________

Divide using Long Division.

1) $(p^3 + 9p^2 + 17p - 1) \div (p + 6)$

2) $(k^3 + 3k^2 - 13k - 24) \div (k + 5)$

3) $(3m^2 - 23m - 2) \div (m - 8)$

4) $(2a^2 - 5a - 60) \div (a - 7)$

5) $(k^3 - 8k^2 + 10k - 4) \div (k - 2)$

6) $(4v^2 + 3v - 20) \div (v + 3)$

7) $(6x^2 - 11x - 5) \div (x - 2)$

8) $(10n^2 + 93n + 33) \div (n + 9)$

2

9) $(x^3 - 2x^2 - 10x - 29) \div (x - 5)$

10) $(7a^2 - 28a + 14) \div (a - 3)$

11) $(4x^2 + 29x + 52) \div (x + 5)$

12) $(7x^3 + 66x^2 + 25x - 28) \div (x + 9)$

13) $(5n^2 - 47n - 27) \div (n - 10)$

14) $(m^3 + 3m^2 - 13m + 9) \div (m - 2)$

15) $(10v^2 + 96v + 45) \div (v + 9)$

State if the given binomial is a factor of the given polynomial.

16) $(x^3 + 7x^2 - 10) \div (x + 7)$

17) $(4n^2 - 20n) \div (n - 5)$

3

18) $(v^3 - 18v^2 + 80v) \div (v - 8)$

19) $(x^3 - 5x^2) \div (x - 5)$

20) $(n^3 - 6n^2 - 2n + 7) \div (n - 1)$

21) $(x^2 + 4x + 6) \div (x + 4)$

22) $(5p^2 + 19p - 30) \div (p + 5)$

23) $(p^3 - 4p^2 + 5p - 50) \div (p - 5)$

24) $(6x^2 - 48x + 7) \div (x - 8)$

25) $(b^3 - 3b^2 - 45b + 54) \div (b + 6)$

4

CP Precalculus Name________________________

2-3: Polynomial Synthetic Division

Date______________

Divide using Synthetic Division.

1) $(4r^2 - 34r + 6) \div (r - 8)$

2) $(x^3 + 11x^2 + 11x - 9) \div (x + 1)$

3) $(4x^2 - 35x + 58) \div (x - 7)$

4) $(10x^2 + 12x - 9) \div (x + 2)$

5) $(3n^3 + 22n^2 + 27n - 37) \div (n + 5)$

6) $(m^3 + 2m^2 - 59m + 39) \div (m + 9)$

7) $(4m^2 + 29m + 39) \div (m + 5)$

8) $(5x^2 - 39x + 60) \div (x - 6)$

9) $(n^2 + 16n + 69) \div (n + 7)$

10) $(x^3 - 10x^2 + 11x + 34) \div (x - 8)$

5

11) $(6v^2 - 12v + 5) \div (v - 2)$

12) $(5k^3 + 20k^2 + 3) \div (k + 4)$

13) $(6k^3 + 36k^2 + 10) \div (k + 6)$

14) $(b^3 - 43b - 48) \div (b + 6)$

15) $(10x^2 - 60x - 4) \div (x - 6)$

16) $(r^2 - r - 7) \div (r - 4)$

17) $(5b^2 - 47b - 32) \div (b - 10)$

18) $(8n^2 - 21n - 19) \div (n - 3)$

19) $(5m^3 - 46m^2 + 2m + 59) \div (m - 9)$

20) $(9m^3 + 72m^2 + 55m - 60) \div (m + 7)$

Long Division of Polynomials -- **Some Helpful Hints** 6

1. Be neat!!! 2. Both dividend and divisor should be written in decreasing powers of the variable.
3. "Missing" powers should be represented by 0 times the variable to that power.
4. Quotient terms should be placed over like terms in the dividend.
5. Avoid adding unlike terms (something's wrong somewhere if unlike terms line up, usually in the set up).
6. The division is over when the degree of the divisor is more than the degree of the remainder.
7. Try not to physically change the signs (of the subtrahend) when subtracting, it gets too confusing.
8. Take your time. Check each step as you go. One little mistake can throw the whole answer off.
9. Check your answers!!! 10. Enjoy!!

The Remainder Theorem-If a polynomial p(x) of degree ≥ 1 is divided by (x-c), then the remainder is p(c). That is, p(x)=q(x)(x-c)+p(c)

Zeros of polynomial functions

The Factor Theorem-For all polynomials p(x), (x-c) is a factor of p(x) iff p(c)=0

For any polynomial p(x), the following are logically equivalent

a) (x-c) is a factor of p(x)
b) p(c)=0
c) c is an x-intercept of the graph of p(x)
d) c is a zero of p(x)
e) The remainder when p(x) is divided by (x-c) is 0

1) $9\overline{)4369}$

2) $2x+1\overline{)6x^3-9x^2+8x+1}$

3) $3x^2+2x\overline{)6x^6-20x^5-7x^4+9x^3-x^2-2x+7}$

4) Divide $6x^5 - x^4 + x + 1$ by $2x^2 + x$

5. State 5 other conclusions you can draw from the following statement:
1 is a solution to $2p^4 + 13p^3 + 12p^2 - 17p - 10$ = p(x)   Hint: look at notes for Factor Theorem

a.

b.

c.

d.

e.

6. Is $(x - 5)$ a factor of $3x^4 - 10x^3 - 25x^2 - 10x - 4$?

7. Is $(x - 5)$ a factor of $3x^4 - 10x^3 - 25x^2 - 10x + 50$?

8. Find an equation for a polynomial function with x-intercepts at -1, -2, and $\frac{5}{6}$.

Synthetic substitution:

$P(2)$ if $P(x) = 3x^3 + x^2 - 8x - 5$

$$\begin{array}{r|rrrr} 2 & 3 & 1 & -8 & -5 \\ & \downarrow & 6 & 14 & 12 \\ \hline & 3 & 7 & 6 & \boxed{7} \end{array} \qquad P(2) = 7$$

Synthetic Division:

Divide $3x^3 + x^2 - 8x - 5$ by $x - 2$

$$\begin{array}{r|rrrr} 2 & 3 & 1 & -8 & -5 \\ & & 6 & 14 & 12 \\ \hline & 3 & 7 & 6 & 7 \end{array} \Rightarrow 3x^2 + 7x + 6 \; \frac{7}{x-2}$$

ex) $6x^5 + x^4 + x^3 - 3x^2 + 9 \div x + \frac{1}{2}$

$$\begin{array}{r|rrrrrr} -\frac{1}{2} & 6 & 1 & 1 & -3 & 0 & 9 \\ & & & & & & \\ \hline & & & & & & \end{array}$$

#4 (has a twist) $4x^4 - 2x^2 + 3x + 1 \div 2x + 1$

$2x + 1 = 2(x + \frac{1}{2})$ so

$$\begin{array}{r|rrrrr} -\frac{1}{2} & 4 & 0 & -2 & 3 & 1 \\ & & -2 & 1 & .5 & -1.75 \\ \hline & 4 & -2 & -1 & 3.5 & -.75 \end{array}$$

$$\frac{4x^3 - 2x^2 - x + 3.5}{2} - \frac{.75}{2x+1}$$

$$2x^3 - x^2 - \frac{1}{2}x + 1.75 - \frac{.75}{2x+1}$$

$n = qd + r$

you mess with the divisor, you mess with the quotient NOT The Remainder

basically, since you only used the $x + \frac{1}{2}$ and not the 2, you have to $\div$ 2 out of the quotient only

9

The Remainder and Factor Theorems

Divide using synthetic division and ~~write your answer in the form dividend = quotient · divisor + remainder~~. Is the binomial a factor of the polynomial?

1. $(4x^3 - 9x^2 - 10x - 2) \div (x - 3)$

2. $(2x^3 + 5x^2 - 9x + 20) \div (x + 4)$

3. $(x^4 - 6x^3 - 2x - 10) \div (x + 1)$

4. $(3x^4 - 9x^3 - 32x^2 + 54) \div (x - 5)$

Given a polynomial and one of its factors, find the remaining factors of the polynomial. Some factors may not be binomials.

5. $x^3 + 6x^2 - x - 30; x + 5$

6. $x^3 - 11x^2 + 36x - 36; x - 6$

7. $2x^3 + 3x^2 - 65x + 84; x - 4$

8. $2x^3 + 15x^2 - 14x - 48; x - 2$

9. $16x^5 + 32x^4 - x - 2; x + 2$

10. $x^4 - 3x^3 + 27x - 81; x - 3$

Find values for k so that each remainder is 5.

11. $(2x^2 - 8x + k) \div (x - 7)$

12. $(x^3 + 4x^2 + kx + 8) \div (x + 2)$

13. $(x^4 + kx^3 - 7x^2 + 8x + 25) \div (x - 2)$

14. $(x^2 + 2x + 6) \div (x + k)$

The Remainder Theorem

Date________________ Period____

Evaluate each function at the given value.

1) $f(x) = -x^3 + 6x - 7$ at $x = 2$

2) $f(x) = x^3 + x^2 - 5x - 6$ at $x = 2$

3) $f(a) = a^3 + 3a^2 + 2a + 8$ at $a = -3$

4) $f(a) = a^3 + 5a^2 + 10a + 12$ at $a = -2$

5) $f(a) = a^4 + 3a^3 - 17a^2 + 2a - 7$ at $a = 3$

6) $f(x) = x^5 - 47x^3 - 16x^2 + 8x + 52$ at $x = 7$

State if the given binomial is a factor of the given polynomial.

7) $(k^3 - k^2 - k - 2) \div (k - 2)$

8) $(b^4 - 8b^3 - b^2 + 62b - 34) \div (b - 7)$

9) $(n^4 + 9n^3 + 14n^2 + 50n + 9) \div (n + 8)$

10) $(p^4 + 6p^3 + 11p^2 + 29p - 13) \div (p + 5)$

11) $(p^4 - 8p^3 + 10p^2 + 2p + 4) \div (p - 2)$

12) $(n^5 - 25n^3 - 7n^2 - 37n - 18) \div (n + 5)$

13) $(x^5 + 6x^4 - 3x^2 - 22x - 29) \div (x + 6)$

14) $(n^4 + 10n^3 + 21n^2 + 6n - 8) \div (n + 2)$

11

More on Factors, Zeros, and Dividing

Date________________ Period____

Factor each and find all zeros. One factor has been given.

1) $f(x) = x^3 + 9x^2 + 23x + 15;\ x + 5$

2) $f(x) = x^3 - x^2 - 14x + 24;\ x - 3$

3) $f(x) = x^4 + 3x^3 - 13x^2 - 15x;\ x - 3$

4) $f(x) = x^3 - 12x^2 + 47x - 60;\ x - 3$

5) $f(x) = x^3 - 7x^2 + 2x + 40;\ x - 5$

6) $f(x) = x^3 - 3x^2 - 9x + 27;\ x - 3$

7) $f(x) = 10x^3 + 37x^2 + 37x + 6;\ 5x + 1$

8) $f(x) = 25x^3 + 150x^2 + 131x + 30;\ 5x + 3$

9) $f(x) = 5x^3 + 21x^2 - 21x - 5;\ x + 5$

10) $f(x) = 3x^3 - 4x^2 - 9x + 10;\ x - 2$

Graphing Poly. Fns. Cubics + Quartics + Worksheet

Name ______________________________

The following polynomial functions are given to you in factored form and some in standard form. Determine the the degrre of the poly. Function, it's x-intercepts, the y-intercept, and the basic "end " behavior. Find at least three additional points to help you sketch the function. Then, sketch!

1. $p(x)=(x+1)(x-3)(x+5)$

   $p(x) = x^3 + 3x^2 - 13x - 15$

2. $p(x)=(x+1)^2(x-5)$

   $p(x) = x^3 - 3x^2 - 9x - 5$

3. $p(x)=-(x+2)(x-4)(x-1)$

   $p(x) = -x^3 + 3x^2 + 6x - 8$

4. $p(x)=-(x-2)^3$

   $p(x) = -x^3 + 6x^2 - 12x + 8$

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

   $p(x) = -4x^3 + 12x^2 + 15x + 4$

6. $p(x)=x(x-5)(x+1)$

   $p(x) = x^3 - 4x^2 - 5x$

13

7. $p(x)=(2x+5)(x+1)(x-2)(x-3)$

8. $p(x)=(x+2)^2\,(x-2)^2$

9. $p(x)=x(x+2)(x-2)^2$

10. $p(x)=(x+4)(x-1)^3$

11. $p(x)=x(x+2)^2\,(x-1)^2$

12. $p(x)=(2x+1)^2(x-3)^3$