Math 3 Name:_____

Unit 3 Day 6 HW Date:_____

Use the long division algorithm to determine the quotient in problems 1–5.

1. $\frac{2x^3-13x^2-x+3}{2x+1}$

2. $\frac{3x^3+4x^2+7x+22}{x+2}$

3. $\frac{x^4+6x^3-7x^2-24x+12}{x^2-4}$

4. $(12x^4 + 2x^3 + x - 3) \div (2x^2 + 1)$

5. $(2x^3 + 2x^2 + 2x) \div (x^2 + x + 1)$

6. **Use long division to find the polynomial, p, that satisfies the equation below.**

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

7. **Given $q(x) = 3x^3 - 4x^2 + 5x + k$.**

   a. **Determine the value of k so that $3x - 7$ is a factor of the polynomial q.**

   b. **What is the quotient when you divide the polynomial q by $3x - 7$?**

8. In parts (a)–(b) and (d)–(e), use long division to evaluate each quotient. Then, answer the remaining questions.

a. $\frac{x^2-9}{x+3}$

b. $\frac{x^4-81}{x+3}$

c. Is $x+3$ a factor of x^3-27? Explain your answer using the long division algorithm.

d. $\frac{x^3+27}{x+3}$

e. $\frac{x^5+243}{x+3}$

f. Is $x+3$ a factor of x^2+9? Explain your answer using the long division algorithm.

g. For which positive integers n is $x+3$ a factor of x^n+3^n? Explain your reasoning.

h. If n is a positive integer, is $x+3$ a factor of x^n-3^n? Explain your reasoning.

Polynomial Long Division Homework Answers

Use the long division algorithm to determine the quotient in problems 1–5.

1. $\dfrac{2x^3-13x^2-x+3}{2x+1}$

   $x^2 - 7x + 3$

2. $\dfrac{3x^3+4x^2+7x+22}{x+2}$

   $3x^2 - 2x + 11$

3. $\dfrac{x^4+6x^3-7x^2-24x+12}{x^2-4}$

   $x^2 + 6x - 3$

4. $(12x^4 + 2x^3 + x - 3) \div (2x^2 + 1)$

   $6x^2 + x - 3$

5. $(2x^3 + 2x^2 + 2x) \div (x^2 + x + 1)$

   $2x$

6. **Use long division to find the polynomial, p, that satisfies the equation below.**

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

   $p(x) = x^2 - 2$

7. **Given $q(x) = 3x^3 - 4x^2 + 5x + k$.**

   a. **Determine the value of k so that $3x - 7$ is a factor of the polynomial q.**

      $k = -28$

   b. **What is the quotient when you divide the polynomial q by $3x - 7$?**

      $x^2 + x + 4$

8. In parts (a)–(b) and (d)–(e), use long division to evaluate each quotient. Then, answer the remaining questions.

a. $\frac{x^2-9}{x+3}$

$x-3$

b. $\frac{x^4-81}{x+3}$

$x^3-3x^2+9x-27$

c. Is $x+3$ a factor of x^3-27? Explain your answer using the long division algorithm.

No. The remainder is not 0 when you perform long division.

d. $\frac{x^3+27}{x+3}$

x^2-3x+9

e. $\frac{x^5+243}{x+3}$

$x^4-3x^3+9x^2-27x+81$

f. Is $x+3$ a factor of x^2+9? Explain your answer using the long division algorithm.

No. The remainder is not 0 when you perform long division.

g. For which positive integers n is $x+3$ a factor of x^n+3^n? Explain your reasoning.

Only if n is an odd number. By extending the patterns in parts (a)–(c) and (e), we can generalize that $x+3$ divides evenly into x^n+3^n for odd powers of n only.

h. If n is a positive integer, is $x+3$ a factor of x^n-3^n? Explain your reasoning.

Only for even numbers n. By extending the patterns in parts (a)–(c), we can generalize that $x+3$ will always divide evenly into the dividend.