Topics: long division, synthetic division, remainder theorem, factor theorem

Student Learning Outcomes:

1. Students will be able to divide polynomials using long division.
2. Students will be able to divide polynomials using synthetic division.
3. Students will be able apply the Remainder and Factor Theorems.

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1 Long Division

1. Use long division to divide $(-5 + x + 4x^2 + 2x^3 + 3x^4) \div (x^2 + 2)$.

2. Use long division to divide $\dfrac{2x^2 + 3x - 14}{x - 2}$.

2 Synthetic Division

3. Use synthetic division to divide $(-10x^2 + 2x^3 - 5) \div (x - 4)$.

4. Use synthetic division to divide $\dfrac{x^4 + 4x^3 - 2x + 18}{x + 2}$.

3 Remainder and Factor Theorems

Remainder Theorem If a polynomial $f(x)$ is divided by $x - c$, then the remainder is $f(c)$.

Note: The remainder theorem tell us that the value of $f(c)$ is the same as the remainder we get from dividing $f(x)$ by $x - c$.

5. Given $f(x) = x^4 + 6x^3 - 12x^2 - 30x + 35$, use the remainder theorem to evaluate $f(2)$.

6. Use the remainder theorem to determine if $c = \sqrt{3}$ is a zero of $f(x) = x^3 + x^2 - 3x - 3$.

Factor Theorem Let $f(x)$ be a polynomial.

(a) If $f(c) = 0$, then $(x - c)$ is a factor of $f(x)$.

(b) If $(x - c)$ is a factor of $f(x)$, then $f(c) = 0$.

7. Use the factor theorem to determine if $x - 3$ is a factor of $f(x) = x^4 - x^3 - 11x^2 + 11x + 12$.

8. Factor $f(x) = 3x^3 + 25x^2 + 42x - 40$, given that -5 is a zero of $f(x)$. Then solve the equation $3x^3 + 25x^2 + 42x - 40 = 0$.

Student Learning Outcomes Check

1. Can you divide polynomials using long division?
2. Can you divide polynomials using synthetic division?
3. Are you able apply the Remainder and Factor Theorems?

If any of your answers were no, please ask about these topics in class.