

From yesterday, section 3.2:

$$11. \ R(x) = -x^5 + 5x^3 - 4x$$

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

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

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

$$43. \ P(x) = x^4 - 3x^2 - 4$$

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

$$\begin{array}{c} -4x^2 \\ 1x^2 \end{array}$$

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

$$x = -2 \quad x = 2$$

3.3 Notes: Dividing Polynomials

$$2x^3 - 7x^2 + 5 \div x - 3$$

rewrite: $x - 3 \overline{)2x^3 - 7x^2 + 0x + 5}$

Be sure to account for
all possible exponents!!

Use parentheses
when subtracting!!

3.3 Notes: Dividing Polynomials

$$\underline{2x^3 - 7x^2 + 5} \div x - 3$$

rewrite: $x - 3 \overline{)2x^3 - 7x^2 + 0x + 5}$

The diagram shows the long division process:

- Step 1:** $\underline{2x^3 - 7x^2 + 5} \div x - 3$. The divisor $x - 3$ is written above the dividend $2x^3 - 7x^2 + 0x + 5$.
- Step 2:** The first term of the dividend, $2x^3$, is divided by the first term of the divisor, x , resulting in $2x^2$. This is written above the division bar.
- Step 3:** $2x^2$ is multiplied by the divisor $x - 3$ to get $2x^3 - 6x^2$. This is written below the first two terms of the dividend and subtracted from them.
- Step 4:** The result of the subtraction is $-x^2 + 0x$. This is written below the line.
- Step 5:** The next term of the dividend, $+5$, is brought down to the line, resulting in $-x^2 + 3x + 5$.
- Step 6:** $-x^2$ is divided by x to get $-x$. This is written above the division bar.
- Step 7:** $-x$ is multiplied by the divisor $x - 3$ to get $-3x + 3$. This is written below the second two terms of the dividend and subtracted from them.
- Step 8:** The result of the subtraction is $-3x + 5$. This is written below the line.
- Step 9:** The next term of the dividend, $+5$, is brought down to the line, resulting in $-3x + 9$.
- Step 10:** $-3x$ is divided by x to get -3 . This is written above the division bar.
- Step 11:** -3 is multiplied by the divisor $x - 3$ to get -9 . This is written below the last term of the dividend and subtracted from it.
- Step 12:** The result of the subtraction is -4 , which is written in a box at the bottom right.

Note: The handwritten work includes several annotations in red and yellow, such as "Be sure to account for all possible exponents!!" and "Use parentheses when subtracting!!".

3.3 Notes: Synthetic Division

(an alternative to dividing polynomials)

$$2x^3 - 7x^2 + 5 \div x - 3$$

$$\text{rewrite: } x - 3 \overline{)2x^3 - 7x^2 + 0x + 5}$$

or rewrite:

The synthetic division diagram shows the process of dividing $2x^3 - 7x^2 + 5$ by $x - 3$. The divisor 3 is written above the first coefficient 2. The quotient is written below the line, and the remainder -4 is enclosed in a blue box. Green arrows indicate the multiplication step (3 times the previous quotient term) and the addition step (adding the remainder to the next term). Red arrows indicate the final addition step where the remainder is added to the last term.

3	2	-7	0	5
↓	6	-3	-9	
2	-1	-3	-4	
quotient				remainder

Synthetic division:
see video in ebook
for more details

$$2x^2 - x - 3 \quad \text{remainder } -4$$

Long Division

$$\begin{array}{r} 2x^2 - x - 3 \quad \text{Quotient} \\ x - 3 \overline{)2x^3 - 7x^2 + 0x + 5} \\ 2x^3 - 6x^2 \\ \hline -x^2 + 0x \\ -x^2 + 3x \\ \hline -3x + 5 \\ -3x + 9 \\ \hline -4 \end{array}$$

Remainder

Synthetic Division

$$\begin{array}{r} 3 | 2 & -7 & 0 & 5 \\ & 6 & -3 & -9 \\ \hline & 2 & -1 & -3 & -4 \\ & \text{Quotient} & \text{Remainder} \end{array}$$

For #16,29,31, please be sure to solve for the quotient and remainder using LONG DIVISION and SYNTHETIC DIVISION.

16. Find the quotient and the remainder using
LONG DIVISION and SYNTHETIC DIVISION.

$$\begin{array}{r} x^3 + 2x^2 - x + 1 \\ \hline x + 3 \end{array}$$

$$\begin{array}{r} x^2 - x + 2 \\ \hline (x+3) | x^3 + 2x^2 - x + 1 \\ - (x^3 + 3x^2) \\ \hline -x^2 - x \\ - (-x^2 - 3x) \\ \hline 2x + 1 \\ - (2x + 6) \\ \hline -5 \end{array}$$

62. FACTOR THEOREM: Show that the given value(s) of c are zeros of $P(x)$, and find all other zeros of $P(x)$

$$2x^4 - 13x^3 + 7x^2 + 37x + 15, \quad c = -1, 3$$

$$\begin{array}{r} -1 \\ \underline{-} 2 -13 7 37 15 \\ \downarrow -2 15 -22 -15 \\ \hline 2 -15 22 15 \quad \boxed{0} \\ \downarrow 6 -27 -15 \\ \hline 2 -9 -5 \quad \boxed{0} \end{array}$$