Topic: 3.5 Dividing Polynomials

Essential Question: How do you divide polynomials?

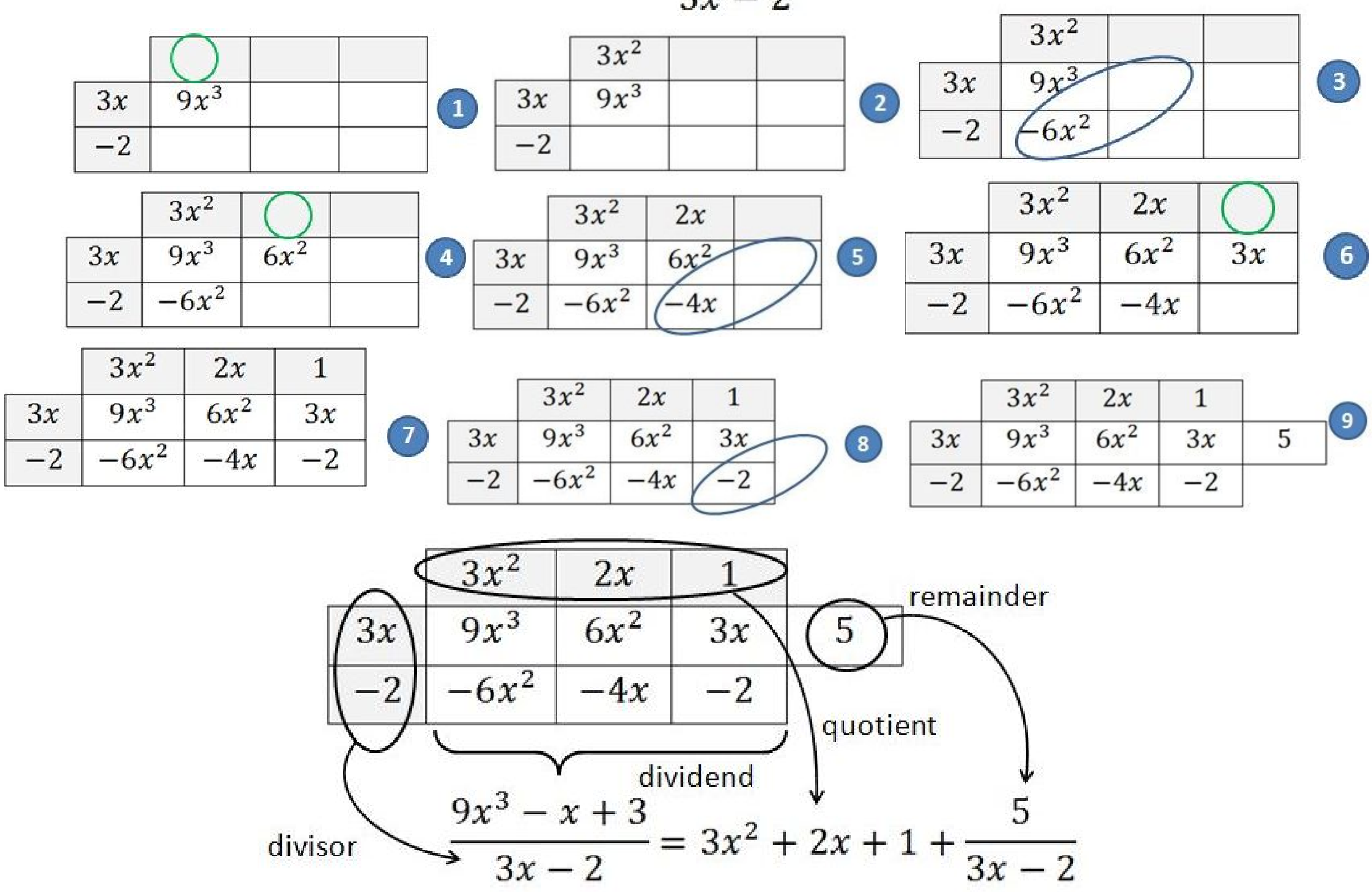
Dividing Polynomials – The Box Method!!!

1. Draw your box.
   a. The height of the box should be **one more than** the degree of the polynomial you are dividing **by**. The length will be determined as we solve the problem, so just draw a few columns and you can add more later.
   b. Write the polynomial you are dividing by down the left edge of the box. Include every term, even if invisible. (So you'd write x^2+1 as x^2+0x+1).
   c. Write the first term of the polynomial being divided in the top left box.
2. Determine what needs to be the first term on top of the top left box to make the multiplication work.
3. Multiply each of the terms on the left edge and the filled in top term to complete the first column of boxes.
4. Determine what needs to be put in the box to make the next diagonal combine to make the next term in the polynomial.
5. Use the terms on the left edge and the newly filled in box to determine the second term on top. Then, fill in the second column.
6. Repeat this process until you write a constant on top of the box (no variable).

(7.) Write an R above the last column. This column will form your remainder.

The polynomial on top of the box with its remainder is your final answer.

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



1) $$\frac{4x^2 - 4x + 3}{2x - 5}$$

2) $$\frac{15x^3 - x^2 - 11x - 3}{3x^2 - 2x - 1}$$

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

Synthetic Division

**The method that only works at certain times and that's why your teacher almost didn't show you but she decided if it will save time later then it's maybe worth showing....

When given $P(x) \div (x + a)$ **see it only works if it's divided by a linear polynomial with no coefficient - pretty limited...

1) Box and change sign of $(x + a)$
2) Write coefficients of $P(x)$ INCLUDING INVISIBLE 0 COEFFICIENTS!!!
3) Bring down first number
4) Multiply diagonally ↗, add down ↓, repeat until you run out of coefficients
5) Write answer starting one degree less than $P(x)$

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

-1	3	-4	2	-1
	↓	-3	7	-9
	3	-7	9	-10

$3x^2 - 7x + 9 + \frac{-10}{x+1}$

$(3x^4 + 19x^3 + 25x^2 - 24x - 27) \div (x + 3)$

<u>Fundamental Theorem of Algebra</u>: A polynomial of the n^{th} degree has exactly *n* complex roots

Solve the Polynomial (find all solutions) using the given information:

1) $f(x) = x^3 + 3x^2 - 13x - 15$; Factor $(x + 5)$

x = ____ ____ ____

2) $y = x^3 - 13x + 12$; Zero -4

x =

3) $f(x) = 2x^3 + 14x^2 + 13x + 6$; $f(-6) = 0$

Solving Polynomials

1) How many answers are there?

2) What are some rational roots?

3) Solve the remaining polynomial

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

ii) $y = x^3 - 5x^2 + 17x - 13$

iii) $9x^4 + 3x^3 - 30x^2 + 6x + 12 = 0$