DATE: __________

**Unit 2 (Chapter 2): Polynomial & Rational Functions** **Pre-Calculus**

# 2.4 Real Zeroes of Polynomial Functions

Target 2B: Find Real and Complex Zeroes of Polynomials by Synthetic and Long Division

*Review of Prior Concepts*

**1.** Write the factored form of the polynomial function that crosses the $x$-axis @ $x = 3$ and $x = -2$ and touches the $x$-axis @ $x = 1$ with a degree of 6.

**2.** Write the factored form of the polynomial function: $f(x) = x^3 - 4x$

**3.** Perform long division to find the remainder of: $1272 \div 7$

**More Practice**

**Factored form of Polynomials**

https://www.youtube.com/watch?v=PmBNhKRhpqE

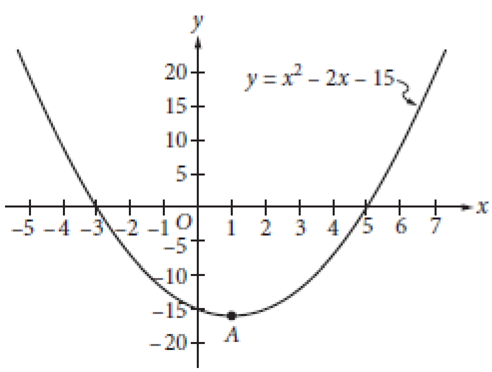
http://www.mathplanet.com/education/algebra-1/factoring-and-polynomials/polynomial-equations-in-factored-form

**SAT Connection**

**Passport to Advanced Mathematics**

**11.** Understand the relationship between zeros and factors of polynomials.

Example:




A) $y = (x + 3)(x - 5)$

B) $y = (x - 3)(x + 5)$

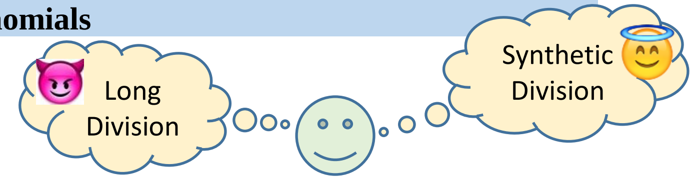
C) $y = x(x - 2) - 15$

D) $y = (x - 1)^2 - 16$

Which of the following is an equivalent form of the equation of the graph shown in the $xy$-plane above, from which the coordinates of vertex $A$ can be identified as constants in the equation?

Solution

## Dividing Polynomials




Divide $f(x) = x^3 + 4x^2 + 7x - 9$ by $d(x) = x + 3$

<u>Long Division</u>

<u>Synthetic Division</u>

- Set divisor equal to zero & solve for *x*.
- Write coefficients of dividend
  (use 0 for any missing term)

*Example:* Divide $f(x) = x^3 + 3x - 4$ by $g(x) = x - 2$

## Remainder Theorem

If a polynomial $f(x)$ is divided by $x - k$, then $f(k)$ = remainder.

*Example:*
Find the remainder when $f(x) = x^3 + 3x - 4$ is divided by $g(x) = x - 2$

To determine if $x - k$ is a factor of a polynomial $f(x)$, use either:

① Synthetic Division

② Remainder Theorem

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*Example:*
Does $f(x) = x^3 - 5x^2 - 18x + 72$ have the factor $g(x) = x - 3$?

<u>Remainder Theorem</u>

<u>Synthetic Division</u>

*Example:*
Find two factors of $f(x) = 3x^4 - 2x^3 - 9x^2 + 4$ using the graphing calculator and find the other factors using synthetic division.

## More Practice

**Real Zeros of Polynomials**
http://www.coolmath.com/algebra/22-graphing-polynomials/05-real-zeros-03
https://people.richland.edu/james/lecture/m116/polynomials/zeros.html

**Synthetic Division**
http://mathbitsnotebook.com/Algebra2/Polynomials/POPolySynDivide.html
http://www.wtamu.edu/academic/anns/mps/math/mathlab/col_algebra/col_alg_tut37_syndiv.htm
http://www.mesacc.edu/~scotz47781/mat120/notes/divide_poly/synthetic/synthetic_division.html
https://www.youtube.com/watch?v=1byR9UEQJN0

**Remainder Theorem & Factor Theorem**
https://www.mathsisfun.com/algebra/polynomials-remainder-factor.html
http://mathbitsnotebook.com/Algebra2/Polynomials/PORemainderTh.html
https://www.youtube.com/watch?v=_IPqCaspZOs

## Homework Assignment

p.205 #1,7,9,10,15,17,22,25,26,27

## SAT Connection

### Solution

**Choice D is correct.** Any quadratic function $q$ can be written in the form $q(x) = a(x - h)^2 + k$, where $a$, $h$, and $k$ are constants and $(h, k)$ is the vertex of the parabola when $q$ is graphed in the coordinate plane. (Depending on the sign of $a$, the constant $k$ must be the minimum or maximum value of $q$, and $h$ is the value of $x$ for which $a(x - h)^2 = 0$ and $q(x)$ has value $k$.) This form can be reached by completing the square in the expression that defines $q$. The given equation is $y = x^2 - 2x - 15$, and since the coefficient of $x$ is $-2$, the equation can be written in terms of $(x - 1)^2 = x^2 - 2x + 1$ as follows: $y = x^2 - 2x - 15 = (x^2 - 2x + 1) - 16 = (x - 1)^2 - 16$. From this form of the equation, the coefficients of the vertex can be read as $(1, -16)$

Choices A and C are incorrect because the coordinates of the vertex $A$ do not appear as constants in these equations. Choice B is incorrect because it is not equivalent to the given equation.