The test covers sections 3.1-3.4 and will be non-calculator

Section 3.1: Quadratic functions

- $f(x) = ax^2 + bx + c$
  - $f(x) = a(x-h)^2 + k$ by completing the square.
  -
  - Find zeros by factoring or quadratic formula
    - $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
  - Vertex of parabola (h, k)
  - Axis of symmetry $x = h$
  - x -intercepts
    - same as zeros or roots of function
    - equidistant to axis of symmetry
    - $h \pm \sqrt{-\dfrac{k}{a}}$
  - y - intercepts
    - $(0, f(0))$
    - same as constant coefficient, $f(0)$
  - If the leading coefficient is 1, a = 1
    - b = sum of roots
    - c = product of roots
- The *x*-coordinate of the vertex is ***where*** the min/max occurs
- the *y*-coordinate is the ***value*** of the min/max.
- Create a quadratic function from given information
- Apply quadratics to word problems

Section 3.2: Polynomial functions and their graphs – ALL NON-CALCULATOR

- $f(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_1 x + a_0$, where a_n
  - end behavior by degree and leading coefficient
  - multiplicity of zero: exponent of corresponding factor
    - The graph ***crosses*** the *x*-axis at zeros of ***odd*** multiplicity.
    - The graph ***bounces off*** the *x*-axis at zeros of ***even*** multiplicity.
  - $x = a$ is a **zero** of $f(x)$: f(a) = 0
    - $(x-a)$ is a **factor** of $f(x)$
    - $(a, 0)$ is an **x-intercept**.

Section 3.3: Dividing polynomials; Remainder & Factor theorems

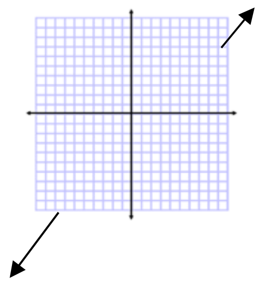
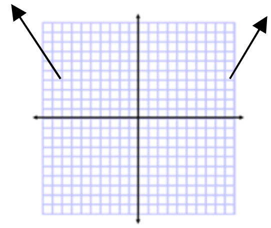
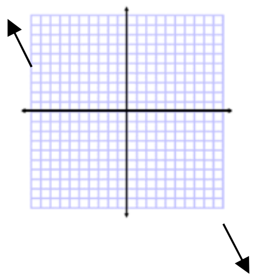
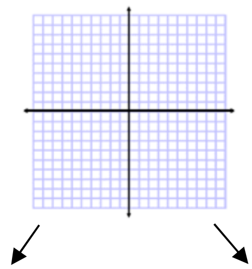
- $D(x)$ is the ***divisor***, $Q(x)$ is the ***quotient***, and $R(x)$ is the ***remainder***.
  - $x = a$ is a **zero** of $f(x)$
  - the remainder is 0 when $f(x)$ is divided by *x*-*a*
- **Remainder Theorem**: $f(c)$ is the remainder of $f(x)$ is divided by $(x-c)$
- **Factor Theorem**: If $f(x)$ has a zero $x = c$, then $(x-c)$ is a factor. The converse is also true.

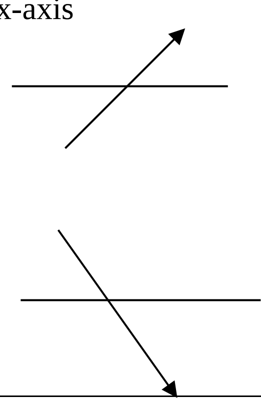
Section 3.4: Zeros of polynomial functions

- **Fundamental Theorem of Algebra**:
  - The number of real and complex zeros (with multiplicity) is equal to the degree of *f*
  - When completely factored, the sum of multiplicities is the degree of *f*.
- **Rational Roots theorem**:
  - Only when $f(x)$ has ***integer coefficients***
  - $\text{rational zeros} = \pm\dfrac{\text{factors of constant coefficient}}{\text{factors of leading coefficient}}$
  - Use to find zeros
    - Step 1: List possible rational roots using Rational Roots Theorem
    - Step 2: Plug in until value is zero or synthetically divide until remainder is zero
    - Step 3:
      - If quotient is a quadratic
        - Factor or use quadratic formula for remaining zeros
      - If quotient is a cubic or higher
        - Go back to step 2
- **Conjugate root theorem**:
  - If $f(x)$ has ***real coefficients***
  - If $f(a + ib) = 0$ then $f(a - ib) = 0$
  - complex zeros will occur in ***conjugate pairs***.
  - If $f(x)$ has ***rational coefficients***
  - If $f(a+\sqrt{b}) = 0$ then $f(a-\sqrt{b}) = 0$
  - radical zeros will occur in ***conjugate pairs***.

STUDY THE DEFINITIONS OF:

- vertex
- axis of symmetry
- x-intercept
- y-intercept
- degree
- coefficient
- leading coefficient
- constant coefficient
- multiplicity
- root
- zero

degree of polynomial	odd degree	even degree
Positive leading coefficient **End behavior**		
Negative leading coefficient **End Behavior**		

Multiplicity of Root	Odd	Even
At the zeros of the polynomial	Crosses x-axis Or 	Touches x-axis Or