# MA 16020 EXAM 3 STUDY GUIDE: ALGEBRA

## DOMAIN & RANGE OF SINGLE VARIABLE FUNCTIONS

**Recall the following common Domains and Ranges:**

1. $y = e^x$ **Domain:** $(-\infty, \infty)$ **Range:** $(0, \infty)$
2. $y = ln(x)$ **Domain:** $(\mathbf{0}, \infty)$ **Range:** $(-\infty, \infty)$

Note that $y = e^x$ and $y = ln(x)$ are inverses of each other. Which mean the domain of the first function is the range of the second (and vice versa).

3. $y = \sqrt{x}$ **Domain:** $[\mathbf{0}, \infty)$ **Range:** $(-\infty, \infty)$
4. $y = \sqrt[3]{x}$ **Domain:** $(-\infty, \infty)$ **Range:** $(-\infty, \infty)$

Note: Let $y = \sqrt[n]{x} = x^{1/n}$.

- If $n$ is even, then **Domain:** $[\mathbf{0}, \infty)$ **Range:** $(-\infty, \infty)$
- If $n$ is odd, then **Domain:** $(-\infty, \infty)$ **Range:** $(-\infty, \infty)$

**Techniques for finding the Domain:**

- Given $\sqrt{?}$ then $? \geq 0$
- Given $ln\ ?$ then $? > 0$
- Given $\frac{1}{?}$ then $? \neq 0$
- Given $\frac{1}{\sqrt{?}}$ then $? > 0$

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## USEFUL DEFINITIONS

1. Point at the origin ⇒ (0,0)

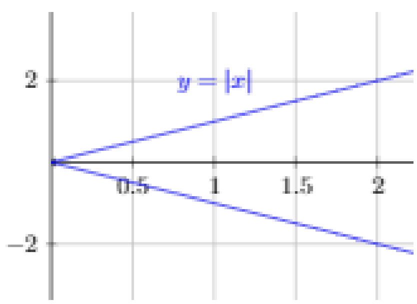
2. Lines ⇒ $y = mx + b$ where $m$ is the slope and $b$ is the y-intercept

3. Parabolas ⇒ $y = a(x-h)^2 + k$ where $(h, k)$ is the vertex of the parabola

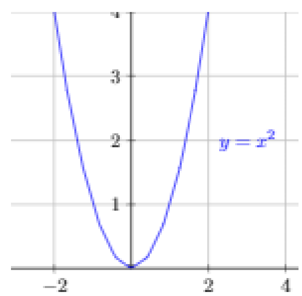
4. Exponential Functions
   a. Increasing ⇒ example $y = e^x$
   b. Decreasing ⇒ example $y = e^{-x}$

5. Logarithmic Functions
   a. Increasing ⇒ example $y = ln\, x$
   b. Decreasing ⇒ example $y = -\, ln\, x$

6. Rational Functions are functions of the form: $y = \frac{p(x)}{q(x)}$
   a. x-axis symmetry
   ⇒ $f(x) = -f(x)$




   b. y-axis symmetry
   ⇒ $f(x) = f(-x)$




7. Circles ⇒ $(x-h)^2 + (y-k)^2 = r^2$ where $r$ is radius and $(h, k)$ is the center

8. Ellipses ⇒ $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$ where $(h, k)$ is the center

9. Hyperbolas ⇒ $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$ where $(h, k)$ is the center

To find the foci for 8 and 9, we use the equation $c^2 = a^2 + b^2$, and solve for $c$.