Notecard:

x & y intercepts

y-intercepts: where the graph crosses the y-axis and $x = 0$ $(0, y)$

x-intercepts: where the graph crosses the x-axis and $y = 0$ $(x, 0)$

intercepts are points on a graph & should be written as ordered pairs!!!
2x + 3y = 6

x-intercept (y = 0)

\[2x + 3(0) = 6\]
\[2x = 6\]
\[x = 3\]
\[(3, 0)\]

y-intercept (x = 0)

\[2(0) + 3y = 6\]
\[3y = 6\]
\[y = 2\]
\[(0, 2)\]
### Characteristics of a Function:

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**Function:** when each domain value is paired with only one range value (no repeating x's)

- graphically: passes the vertical line test

**Function notation:** $f(x)$ "f of x" $f(\heartsuit)$ $f(\odot)$

means: function named $f$ is written using x's

$f(x) = y$ 

$f(\heartsuit) = \star$
Vertical Line Test: no vertical line will intersect a function in more than one point

Mapping Form: are there any x's that have been repeated
Vocabulary

**Continuous:** A function is continuous if you can draw it in one motion without picking up your pencil.

**Discrete:** made of ordered prs. or individual pts.
Domain & Range

**Domain:** x-values - input
- read x's from left to right (smallest to largest)

*some functions have domain restrictions - can't divide by zero
- to find: set the denominator = 0 and solve for x. These are the restrictions.

Can't have a neg. # in a sq. root
- to find: set the radicand ≥ 0 and solve for x.

**Range:** y-values - output
- read y's from bottom to top (smallest to largest)
Domain Restrictions:
1. Exclude any value that makes the denominator = 0

2. Exclude values that lead to the $\sqrt{\text{negative}}$ of a negative number

Find the Domain:

\[ f(x) = \sqrt{3 - x} \]

\[ f(x) = \frac{1}{x+1} + \frac{5x}{3x+2} \]

\[ \mathbb{R}, x \neq -1, x \neq -\frac{2}{3} \]

\[ (-\infty, -1) \cup (-1, -\frac{2}{3}) \cup (-\frac{2}{3}, 0) \]
Continuity: A function is continuous if you can draw it in one motion without picking up your pencil. (It is frequently related to the denominator and restrictions in the domain.)

- removable: hole
- essential: jump
  infinite (asymptotes)
Continuous for all values of $x$

Removable discontinuity at $x=a$
(removable because we could fill it)

Jump discontinuity
(cant plug the hole)

Infinite discontinuity at $x=a$
Increasing, Decreasing and Constant

- as you move from left to right the y-values increase
- as you move from left to right the y-values decrease
- as you move from left to right the y-values do not change

This behavior is reported using interval notation for the x-values where the graph has a certain behavior.
Extrema

maximums
· relative (local)
· absolute (upper bound)

minimums
· relative (local)
· absolute (lower bound)
Odd/Even/Neither Symmetry

Odd \( f(-x) = -f(x) \)
\[ \text{symmetry with respect to the origin} \]

Even \( f(-x) = f(x) \)
\[ \text{symmetry with respect to the y-axis} \]

Neither
Split back into 3rds

\[
y = x^2
\]

\[
f(x) = x^2
\]

\[
f(-x) = (-x)^2
\]

\[
= (-x)(-x)
\]

\[
= x^2
\]

\[
\text{EVEN}
\]
\[ y = x^3 \]
\[ f(x) = x^3 \]
\[ f(-x) = (-x)^3 = (-x)(-x)(-x) = -x^3 \]
\[ -f(x) = -(x^3) = -x^3 \]

ODD
\[ y = x^3 - 2x - 7 \]
\[ f(-x) = (-x)^3 - 2(-x) - 7 \]
\[ = -x^3 + 2x - 7 \]
\[ -f(x) = -((x^3 - 2x - 7)) \]
\[ = -x^3 + 2x + 7 \]

NEITHER
Asymptotes:

**vertical (VA):** caused by dividing by 0
the graph approaches $-\infty$ or $\infty$
on each side of the asymptote
to find the asymptote set $\text{den} = 0$ and solve

**end behavior:** (horizontal (HA) or oblique (OA)):
to find the asymptote - compare the degrees of the num and den. if top heavy (OA):
bottom heavy (HA): $y = 0$
equal (HA): divide coefficients

**oblique:** (more later)
Find the vertical asymptotes:

\[ y = \frac{2 - x}{x - 5} \]

\[ y = \frac{1}{x^2 - 4} \]

\[ y = \frac{x + 5}{x^2 + 5} \]

\[ x - 5 = 0 \]
\[ +5 +5 \]
\[ x = 5 \]

\[ x^2 - 4 = 0 \]
\[ +4 +4 \]
\[ \sqrt{x^2 - 4} \]
\[ x = \pm 2 \]

NO V.A.
Find the horizontal asymptotes:

\[ y = \frac{2-x}{x-5} \]

\[ y = \frac{1}{x^2 - 4} \]

\[ y = \frac{4x^2 + 5}{x^2 + 5} \]

\[ y = \frac{3x^2}{x - 7} \]

- \( D: \frac{1}{x} \)
- \( y = -1 \)
- \( y = 0 \)
- \( y = 4 \)
- oblique asymptote