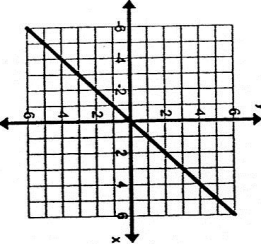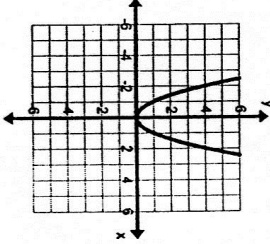# Parent Functions Notes

VOCABULARY

There are several types of functions (linear, exponential, quadratic, absolute value, etc.). Each of these could be considered a family with unique characteristics that are shared among the members. The **parent function** is the basic function that is used to create more complicated functions.
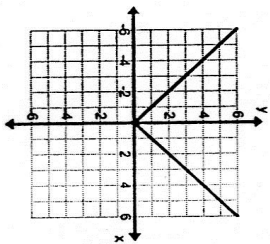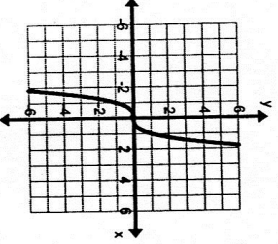
Linear Function

Parent Function

$f(x) = x$

Key Features

Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

Intercepts: x-intercept $(0,0)$, y-intercept $(0,0)$

Intervals of Increasing/Decreasing: increasing $(-\infty, \infty)$

Intervals where Positive/Negative: positive $(0, \infty)$, negative $(-\infty, 0)$

Relative maximums/minimums: none

Symmetries: odd

End Behavior: right end behavior $\lim_{x \to \infty} x = \infty$; left end behavior $\lim_{x \to -\infty} x = -\infty$
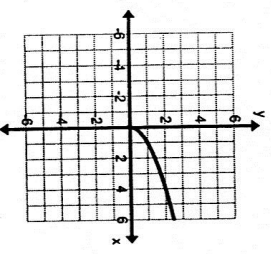
Quadratic Function

Parent Function

$f(x) = x^2$

Key Features

Domain: $(-\infty, \infty)$

Range: $[0, \infty)$

Intercepts: x-intercept $(0,0)$, y-intercept $(0,0)$

Intervals of Increasing/Decreasing: increasing $(0, \infty)$, decreasing $(-\infty, 0)$

Intervals where Positive/Negative: positive $(-\infty, 0) \cup (0, \infty)$

Relative maximums/minimums: minimum at $(0,0)$

Symmetries: even

End Behavior: right end behavior $\lim_{x \to \infty} x^2 = \infty$; left end behavior $\lim_{x \to -\infty} x^2 = \infty$

Absolute Value Function

Parent Function

$f(x) = |x|$

Key Features

Domain: $(-\infty, \infty)$

Range: $[0, \infty)$

Intercepts: x-intercept $(0,0)$, y-intercept $(0,0)$

Intervals of Increasing/Decreasing: increasing $(0, \infty)$, decreasing $(-\infty, 0)$

Intervals where Positive/Negative: positive $(-\infty, 0) \cup (0, \infty)$

Relative maximums/minimums: minimum at $(0,0)$

Symmetries: even

End Behavior: right end behavior $\lim_{x \to \infty} |x| = \infty$; left end behavior $\lim_{x \to -\infty} |x| = \infty$
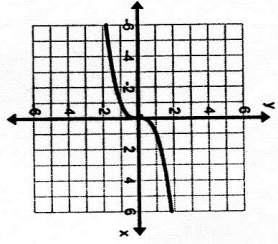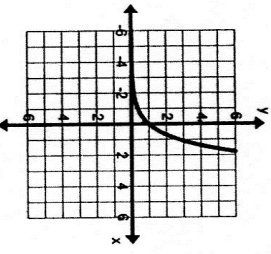
Parent Function

$f(x) = x^3$

Key Features

Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

Intercepts: x-intercept $(0,0)$, y-intercept $(0,0)$

Intervals of Increasing/Decreasing: increasing $(-\infty, \infty)$

Intervals where Positive/Negative: positive $(0, \infty)$, negative $(-\infty, 0)$

Symmetries: odd

Relative maximums/minimums: none

End Behavior: right end behavior $\lim\limits_{x \to \infty} x^3 = \infty$; left end behavior $\lim\limits_{x \to -\infty} x^3 = -\infty$

Cube Root Function

Parent Function

$f(x) = \sqrt[3]{x} = x^{1/3}$

Key Features

Domain: $(-\infty, \infty)$

Range: $(-\infty, \infty)$

Intercepts: x-intercept $(0,0)$, y-intercept $(0,0)$

Intervals of Increasing/Decreasing: increasing $(-\infty, \infty)$

Intervals where Positive/Negative: positive $(0, \infty)$, negative $(-\infty, 0)$

Symmetries: odd

Relative maximums/minimums: none

End Behavior: right end behavior $\lim\limits_{x \to \infty} \sqrt[3]{x} = \infty$; left end behavior $\lim\limits_{x \to -\infty} \sqrt[3]{x} = -\infty$

Square Root Function

Parent Function

$f(x) = \sqrt{x} = x^{1/2}$

Key Features

Domain: $[0, \infty)$

Range: $[0, \infty)$

Intercepts: x-intercept $(0,0)$, y-intercept $(0,0)$

Intervals of Increasing/Decreasing: increasing $(0, \infty)$

Intervals where Positive/Negative: $(0, \infty)$

Relative maximums/minimums: minimum at $(0,0)$

Symmetries: none

End Behavior: right end behavior $\lim\limits_{x \to \infty} \sqrt{x} = \infty$; left end behavior $\lim\limits_{x \to 0} \sqrt{x} = 0$

Exponential Function

Parent Function

$f(x) = a^x$ or $f(x) = e^x$

Key Features

Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

Intercepts: y-intercept $(0,1)$

Intervals of Increasing/Decreasing: increasing $(-\infty, \infty)$

Intervals where Positive/Negative: positive $(-\infty, \infty)$

Relative maximums/minimums: none

Symmetries: none

End Behavior: right end behavior $\lim\limits_{x \to \infty} e^x = \infty$; left end behavior $\lim\limits_{x \to -\infty} e^x = 0$