MAT 012 Lecture Notes, Ch 10, Suppl. A: Introduction to Roots

Example: $x^2 = 49$ has two solutions

$x = 7$ or $x = -7$ (same as $x = \pm 7$)

Example: Solve $x^2 = 121$

$x = 11$ or $x = -11$

Example: Solve $x^2 = -16$

No solutions (same as $\varnothing$)

Example: Solve $x^3 = 64$

$x = 4$

Example: Solve $x^3 = -8$

$x = -2$

Example: Solve $x^4 = -81$

No solutions

Example: Evaluate $\sqrt{\frac{144}{25}} = \frac{12}{5}$ (same as $2\frac{2}{5}$)

Example: Evaluate $\sqrt{36} = 6$

Example: Evaluate $\sqrt{0} = 0$

Example: Evaluate $-\sqrt{81} = -9$ but $\sqrt{-81}$ is undefined in the real numbers

Example: Evaluate $\sqrt{0.0025} = 0.05$

Example: Evaluate $\sqrt[3]{-125} = -5$

Example: Assuming that x is positive, simplify $\sqrt{16x^2} = 4x$

Vocabulary:
Square root, radical sign, radicand (expression under the radical sign), radical expression (includes a "$\sqrt{\ }$" somewhere), cube root (solves $x^3 = \#$), 4^{th}-root (solves $x^4 = \#$), n^{th}-root (solves $x^n = \#$)

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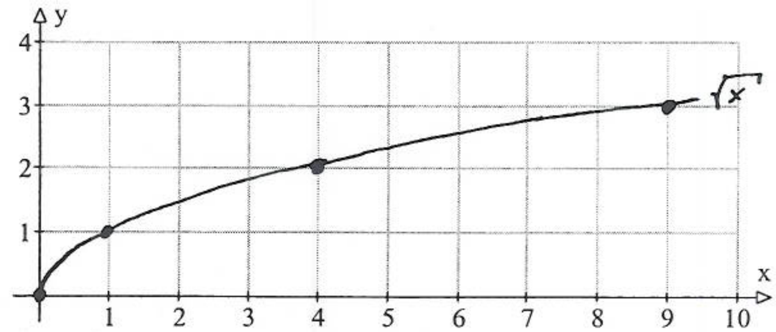
The square root function

$f(x)=\sqrt{x}$ Graph $f(x)$

x	$f(x)=\sqrt{x}$
0	$\sqrt{0}=0$
1	$\sqrt{1}=1$
4	$\sqrt{4}=2$
9	$\sqrt{9}=3$



Domain: $[0,\infty)$ same as $x \geq 0$, same as $\{x \in \mathbb{R} \mid x \geq 0\}$

Range: $[0,\infty)$ same as $y \geq 0$, same as $\{y \in \mathbb{R} \mid y \geq 0\}$

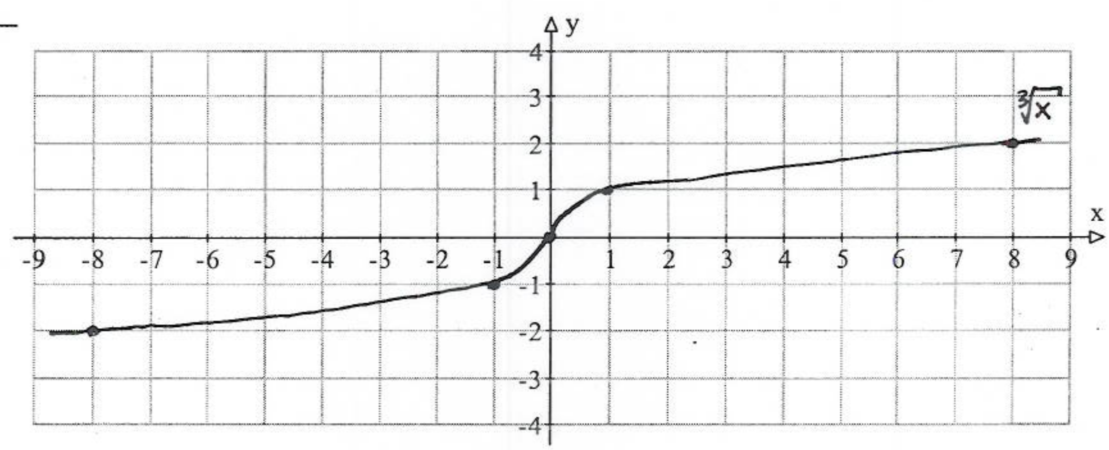
Example: Let $f(x)=\sqrt{2x+5}$, evaluate $f(10)$

$$f(10)=\sqrt{2\cdot 10+5} = \sqrt{25} = 5$$

The cube root function

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

x	$f(x)=\sqrt[3]{x}$
-8	$\sqrt[3]{-8}=-2$
-1	$\sqrt[3]{-1}=-1$
0	$\sqrt[3]{0}=0$
1	$\sqrt[3]{1}=1$
8	$\sqrt[3]{8}=2$



Domain: $\mathbb{R}$

Range: $\mathbb{R}$

Example: Let $f(x)=\sqrt[3]{12-5x}$, evaluate $f(4)$

$$f(4)=\sqrt[3]{12-5\cdot 4} = \sqrt[3]{12-20} = \sqrt[3]{-8} = -2$$

Take the rest of the notes on notebook paper