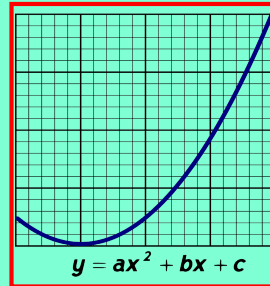


Math 125
Fall 2021
Lecture 42



1) Simplify $\sqrt{(-5)^2 - 3^2}$
 $= \sqrt{25 - 9} = \sqrt{16} = \boxed{4}$

2) Evaluate $g(-3)$ for $g(x) = -\sqrt{57 - 8x}$
 $g(-3) = -\sqrt{57 - 8(-3)} = -\sqrt{57 + 24} = -\sqrt{81} = \boxed{-9}$

3) Find domain of $f(x) = \sqrt{12 - 3x}$
 Index = 2
 even index \rightarrow Radicand $\geq 0 \rightarrow -3x \geq -12$
 $12 - 3x \geq 0 \rightarrow \boxed{x \leq 4}$
 $\boxed{(-\infty, 4]}$

Assume $x \geq 0$ Simplify

$$1) \sqrt{25x^2} = \sqrt{(5x)^2} = \boxed{5x}$$

$$2) \sqrt[3]{-27x^3} = \sqrt[3]{(-3x)^3} = \boxed{-3x}$$

$$3) \sqrt[4]{81x^4} = \sqrt[4]{(3x)^4} = \boxed{3x}$$

$$4) \sqrt{50x^3} = \sqrt{25x^2} \sqrt{2x} = \boxed{5x\sqrt{2x}}$$

$$5) \sqrt[3]{24x^5} = \sqrt[3]{8x^3} \sqrt[3]{3x^2}$$

$$= \sqrt[3]{(2x)^3} \sqrt[3]{3x^2} = \boxed{2x\sqrt[3]{3x^2}}$$

Simplify: $\sqrt{8} - \sqrt{50} - \sqrt{128}$

$$= \sqrt{4}\sqrt{2} - \sqrt{25}\sqrt{2} - \sqrt{64}\sqrt{2}$$

$$= 2\sqrt{2} - 5\sqrt{2} - 8\sqrt{2}$$

$$= \boxed{-11\sqrt{2}}$$

Simplify $3\sqrt{10}(-2\sqrt{20} + 4\sqrt{5})$

$$= -6\sqrt{200} + 12\sqrt{50}$$

$$= -6\sqrt{100}\sqrt{2} + 12\sqrt{25}\sqrt{2}$$

$$= -60\sqrt{2} + 60\sqrt{2} = \boxed{0}$$

Simplify $(5\sqrt{2} - 2\sqrt{5})^2$

$$= (5\sqrt{2} - 2\sqrt{5})(5\sqrt{2} - 2\sqrt{5})$$

$$= 25\sqrt{4} - 10\sqrt{10} - 10\sqrt{10} + 4\sqrt{25}$$

$$= 25 \cdot 2 - 20\sqrt{10} + 4 \cdot 5 = \boxed{70 - 20\sqrt{10}}$$

Rationalize the denominator:

$$1) \frac{4}{\sqrt{20}} \cdot \frac{\sqrt{20}}{\sqrt{20}} = \frac{4\sqrt{20}}{\sqrt{400}} = \frac{4\sqrt{20}}{20} = \frac{\sqrt{20}}{5} = \frac{\sqrt{4\sqrt{5}}}{5} = \frac{2\sqrt{5}}{5}$$

$$2) \frac{-3\sqrt{5}}{\sqrt{5} - \sqrt{2}} \cdot \frac{\sqrt{5} + \sqrt{2}}{\sqrt{5} + \sqrt{2}} \rightarrow \boxed{-5 - \sqrt{10}}$$

$$= \frac{-3\sqrt{25} - 3\sqrt{10}}{\sqrt{25} + \sqrt{10} - \sqrt{10} - \sqrt{4}} = \frac{-3 \cdot 5 - 3\sqrt{10}}{5 - 2} = \frac{-15 - 3\sqrt{10}}{3}$$

$$= \frac{-15}{3} - \frac{3\sqrt{10}}{3} = \boxed{-5 - \sqrt{10}}$$

$$1) \text{Simplify: } \sqrt{-75} = \sqrt{25} \sqrt{3} \sqrt{-1}$$

$$= \boxed{5\sqrt{3}i} = 5i\sqrt{3}$$

$$2) \text{Divide: } \frac{25i}{4+3i} = \frac{25i(4-3i)}{(4+3i)(4-3i)}$$

$$= \frac{25i(4-3i)}{25} = 4i - 3i^2$$

$$= \boxed{3+4i}$$

$$3) \text{Simplify: } i^{251}$$

$$= i^{250} \cdot i = (i^2)^{125} \cdot i = (-1)^{125} \cdot i$$

$$= \boxed{-i}$$

Solve

$$\sqrt{2x+5} - \sqrt{x-2} = 3$$

$$\sqrt{2x+5} = 3 + \sqrt{x-2}$$

$$(\sqrt{2x+5})^2 = (3 + \sqrt{x-2})^2$$

$$2x+5 = (3 + \sqrt{x-2})(3 + \sqrt{x-2})$$

$$(x-2)(x-2) = 36(x-2)$$

$$x^2 - 2x - 2x + 4 = 36x - 72$$

$$x^2 - 4x + 4 - 36x + 72 = 0$$

$$x^2 - 40x + 76 = 0$$

$$(x-38)(x-2) = 0$$

$$x=38 \quad x=2$$

$\{2, 38\}$

Check $x=38$

$$\sqrt{2(38)+5} - \sqrt{38-2} = 3$$

$$\sqrt{76+5} - \sqrt{36} = 3$$

$$\sqrt{81} - \sqrt{36} = 3$$

$$9 - 6 = 3 \checkmark$$

$x=2$

$$\sqrt{2(2)+5} - \sqrt{2-2} = 3$$

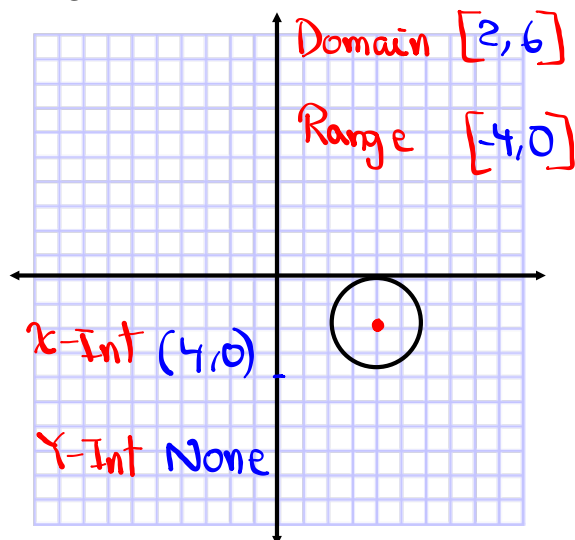
$$\sqrt{9} - \sqrt{0} = 3$$

$$3 = 3 \checkmark$$

Given $(x-4)^2 + (y+2)^2 = 4$

Center $(4, -2)$

Radius 2

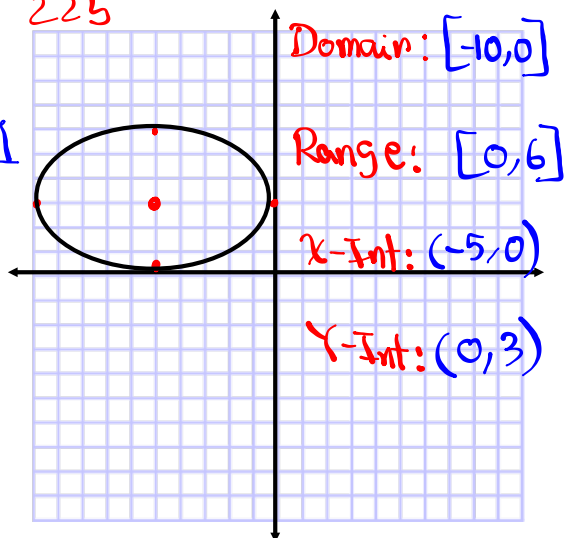


Given $9(x+5)^2 + 25(y-3)^2 = 225$ Hint: Make RHS=1

$$\frac{9(x+5)^2}{225} + \frac{25(y-3)^2}{225} = \frac{225}{225}$$

$$\frac{(x+5)^2}{25} + \frac{(y-3)^2}{9} = 1$$

Graph

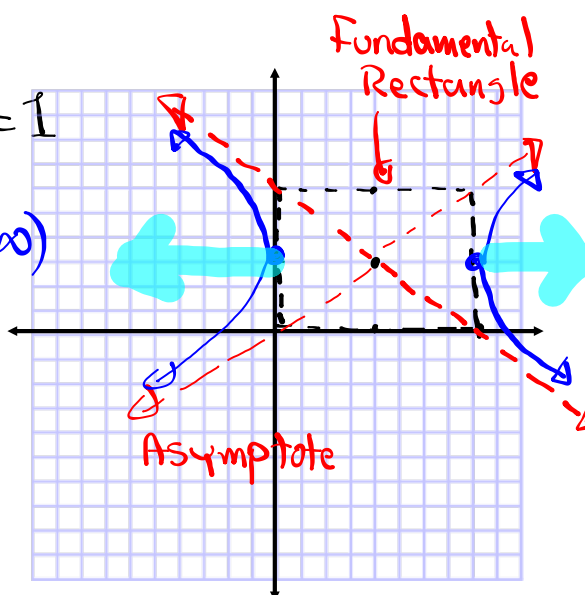


Graph

$$\frac{(x-4)^2}{16} - \frac{(y-3)^2}{9} = 1$$

Domain: $(-\infty, 0] \cup [8, \infty)$

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



Graph

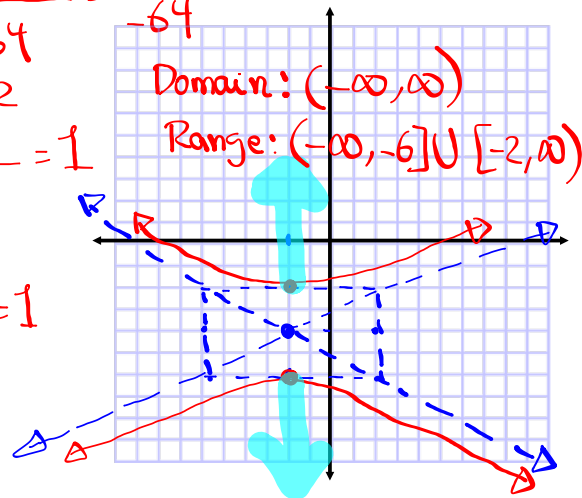
$$4(x+2)^2 - 16(y+4)^2 = -64$$

Hint:
Make RHS=1

$$\frac{4(x+2)^2}{-64} - \frac{16(y+4)^2}{-64} = \frac{-64}{-64}$$

$$-\frac{(x+2)^2}{16} + \frac{(y+4)^2}{4} = 1$$

$$\frac{(y+4)^2}{4} - \frac{(x+2)^2}{16} = 1$$



Solve

$$\begin{cases} x^2 - 4y = 4 \\ 4x + y = -1 \end{cases}$$

$$\Rightarrow \begin{cases} x^2 - 4y = 4 \\ \underline{4x + 4y = -4} \end{cases}$$

$$x^2 + 4x = 0$$

$$x(x+4) = 0$$

$$\downarrow \quad \hookrightarrow x = -4$$

$$x = 0$$

$$y = -1$$

$$y = 3$$

$$\{(0, -1), (-4, 3)\}$$

Solve

$$\begin{cases} 3\{3x^2 + 2y^2 = 35 \\ -2\{4x^2 + 3y^2 = 48 \end{cases} \Rightarrow \begin{cases} 9x^2 + 6y^2 = 105 \\ -8x^2 - 6y^2 = -96 \end{cases}$$

$$\underline{\hspace{10em}}$$

$$x^2 = 9$$

$$\boxed{x = \pm 3}$$

$$3(9) + 2y^2 = 35$$

$$2y^2 = 8$$

$$y^2 = 4$$

$$\boxed{y = \pm 2}$$

$$\{(3, 2), (3, -2), (-3, 2), (-3, -2)\}$$

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Solve:

$$\begin{cases} 3\{3x^2 + 4y^2 = 16 \\ 4\{2x^2 - 3y^2 = 5 \end{cases} \Rightarrow \begin{cases} 9x^2 + 12y^2 = 48 \\ 8x^2 - 12y^2 = 20 \end{cases}$$

$$\underline{\hspace{10em}}$$

$$17x^2 = 68$$

$$x^2 = 4$$

$$\boxed{x = \pm 2}$$

$$3(4) + 4y^2 = 16$$

$$12 + 4y^2 = 16$$

$$4y^2 = 4$$

$$y^2 = 1$$

$$\boxed{y = \pm 1}$$

$$\{(2, 1), (2, -1), (-2, 1), (-2, -1)\}$$