

1. Answer the following questions from the information provided below.

Suppose organic waste was dumped into a retention pond. Part of the decomposition process includes oxidation, whereby oxygen that is dissolved in the pond water is combined with decomposing material. The oxygen level L in the pond can be modeled by $L = \frac{t^2 - t + 1}{t^2 + 1}$ where t represents the number of weeks **after** the waste is dumped. The normal oxygen level in the pond is $L = 1$.

a. Is the equation for L above considered to be a rational equation? Explain your answer.

Yes, we have a polynomial ÷ polynomial.

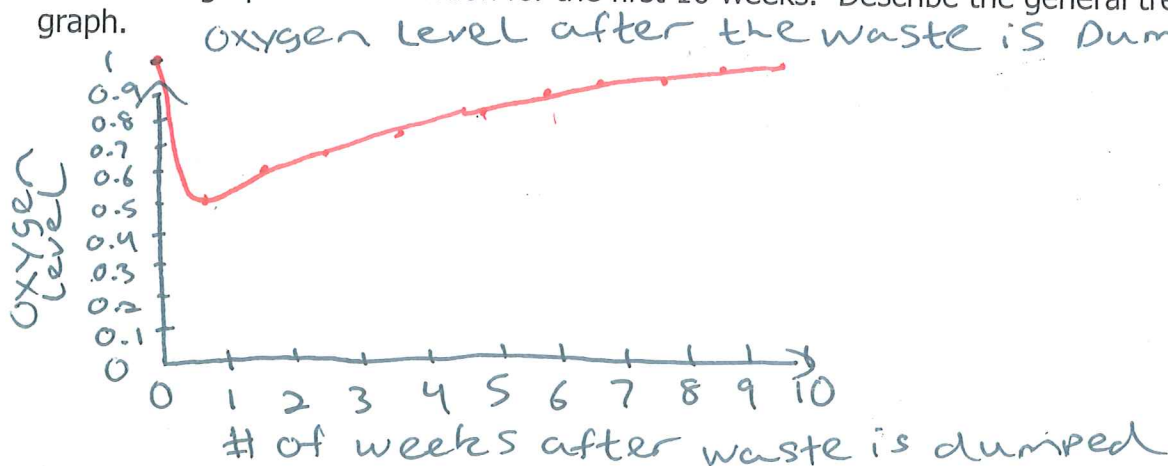
(3, 0.7)

b. Is $(3, \frac{7}{10})$ a solution to the equation above? If so explain the significance/meaning of this ordered pair in the content of the problem.

yes, (3, 0.7) is on the table.

3 weeks after the waste is dumped, the oxygen level recovers to 0.7.

c. Create a graph of the function for the first 10 weeks. Describe the general trends of the graph.

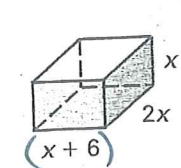


d. Regional biologists consider the pond to have fully recovered from the dumping when the water has recorded an oxygen level of .94. Does this ever occur? If so, after how many weeks?

yes, between 16-17 weeks after the waste is dumped.

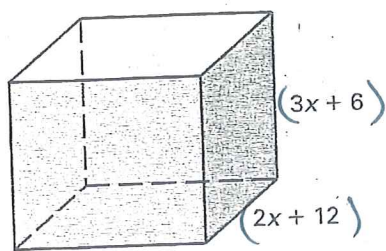
Local farmers use crates to transport their produce to markets safely. The crates are in the shape of rectangular prisms. You may recall from Geometry that the volume of a rectangular prism is found by multiplying the length, width and height. Farmers use two different size crates. The larger is used for commercial clients, where the smaller is used for direct sales to local customers.

2. Use the diagrams below to find the **ratio of the volume of the larger crate to the volume of the smaller crate**. Write your answer in simplified form. (3 pts)



Small crate

$$V = x \cdot 2x \cdot (x+6)$$



Large crate

$$V = 4x(2x+12)(3x+6)$$

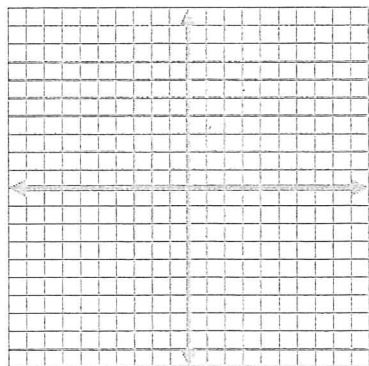
$$\frac{\text{Volume of larger crate}}{\text{Volume of smaller crate}} = \frac{4x(2x+12)(3x+6)}{2x^2(x+6)}$$

$$= \frac{4x \cdot 2(x+6) \cdot 3(x+2)}{2x^2(x+6)}$$

$$= \frac{12 \cancel{4x} (x+6) (x+2)}{1 \cancel{2x^2} (x+6)}$$

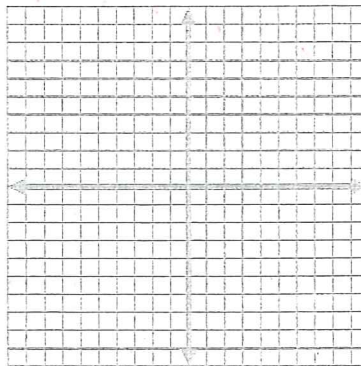
$$= \frac{12(x+2)}{x}$$

3. Graph $y = \frac{-1}{x-2} + 4$



- What is the domain? _____
- What is the range? _____
- What is the end behavior for the function?

4. Graph $y = \frac{2}{x+1}$



- What is the domain? _____
- What is the range? _____
- What is the end behavior for the function?

Simplify the rational expression. If is not possible, indicate with NP. State any restricted values for the expression. Show all work.

5. $\frac{3x^2 - 6x - 24}{x^2 + 7x + 10}$

$$= \frac{3(\cancel{x^2} - 2\cancel{x} - 8)}{x^2 + 7x + 10}$$

$$= \frac{3(\cancel{x-4})(\cancel{x+2})}{(\cancel{x+2})(x+5)}$$

$$= \frac{3(x-4)}{(x+5)}, x \neq -2, -5$$

6. $\frac{x^3 - 27}{x^2 - 9}$

$$= \frac{(x-3)(x^2 + 3x + 9)}{(x+3)(x-3)}$$

$$= \frac{(x^2 + 3x + 9)}{(x+3)}, x \neq -3, 3$$

Not Possible

$$a = \sqrt[3]{x^3} = x$$

$$b = \sqrt[3]{27} = 3$$

$$\begin{matrix} 27 \\ \div 3 \\ \hline 9 \\ \div 3 \\ \hline 3 \\ \div 3 \\ \hline 1 \end{matrix}$$

$$\frac{9x^2}{3x}$$

7. $\frac{2x^2 + 7}{4x}$

Not factorable

NP (Not Possible)

8. $\frac{2x-6}{3-x} = \frac{2(x-3)}{(3-x)}$

$$= \frac{2(\cancel{x-3})}{-1(\cancel{x-3})}$$

$$= \frac{2}{-1}$$

$$= -2, x \neq 3$$

Perform the mathematical operation indicated. Simplify all answers. Show all work.

$$9. \frac{3x^2 - 15x}{3x} \cdot \frac{2x^2 - 10x}{x^2 - 10x + 25}$$

~~3x=0~~
x=0

$$= \frac{3x(x-5)}{3x} \cdot \frac{2x(x-5)}{(x-5)(x-5)}$$

$$= \frac{2x^2(x-5)(x-5)}{13x(x-5)(x-5)}$$

$$= 2x, x \neq 0, 5$$

$$10. \frac{(x^2 + 9x + 18)}{1} \div \frac{x^2 - 3x - 18}{x^2 - 9x + 18}$$

$$= \frac{(x+6)(x+3)}{1} \div \frac{(x-6)(x+3)}{(x-6)(x-3)}$$

$$= \frac{(x+6)(x+3)}{1} \cdot \frac{(x-6)(x-3)}{(x-6)(x+3)}$$

$$= \frac{(x+6)(x+3)(x-6)(x-3)}{(x-6)(x+3)}$$

$$= (x+6)(x-3), x \neq 6, 3, -3$$

$$11. \frac{x^3 + 4x}{2x-1} \div \frac{x^4 - 16}{x^2 - 4x - 12}$$

$a = \sqrt{x^4} = x^2$ $b = \sqrt{16} = 4$
 $a = \sqrt{x^2} = x$ $b = \sqrt{4} = 2$

$$= \frac{x(x^2+4)}{2x-1} \div \frac{(x^2+4)(x^2-4)}{(x-6)(x+2)}$$

$$= \frac{x(x^2+4)}{2x-1} \cdot \frac{(x^2+4)(x+2)(x-2)}{(x-6)(x+2)}$$

$$= \frac{x(x^2+4)}{(2x-1)} \cdot \frac{(x-6)(x+2)}{(x^2+4)(x+2)(x-2)}$$

$$= \frac{x(x-6)(x+2)}{(2x-1)(x^2+4)(x+2)(x-2)}$$

$$= \frac{x(x-6)}{(2x-1)(x-2)}, x \neq 6, -2, \frac{1}{2}, 2$$

$$12. \frac{6x^3y}{xy^2} \cdot \frac{3x^2y}{8x^3} = \frac{18x^5y^2}{8x^4y^2}$$

$\sqrt{x^4y^4} = x^2y^2$
 $x=0$
 $y^2=0$
 $y=0$

$$= \frac{9x}{4}$$

$x \neq 0$
 $y \neq 0$