

Lesson 8 Seasonal Systems

A Solidify Understanding Task

Family Kingdom Amusement Park is planning to hire more support staff to work during the summer months. They have budgeted \$12,000 per week to go towards the pay for these seasonal workers.



Image Source: <https://i.pinimg.com/en/carnival-summer-concession-stand-2456911/>

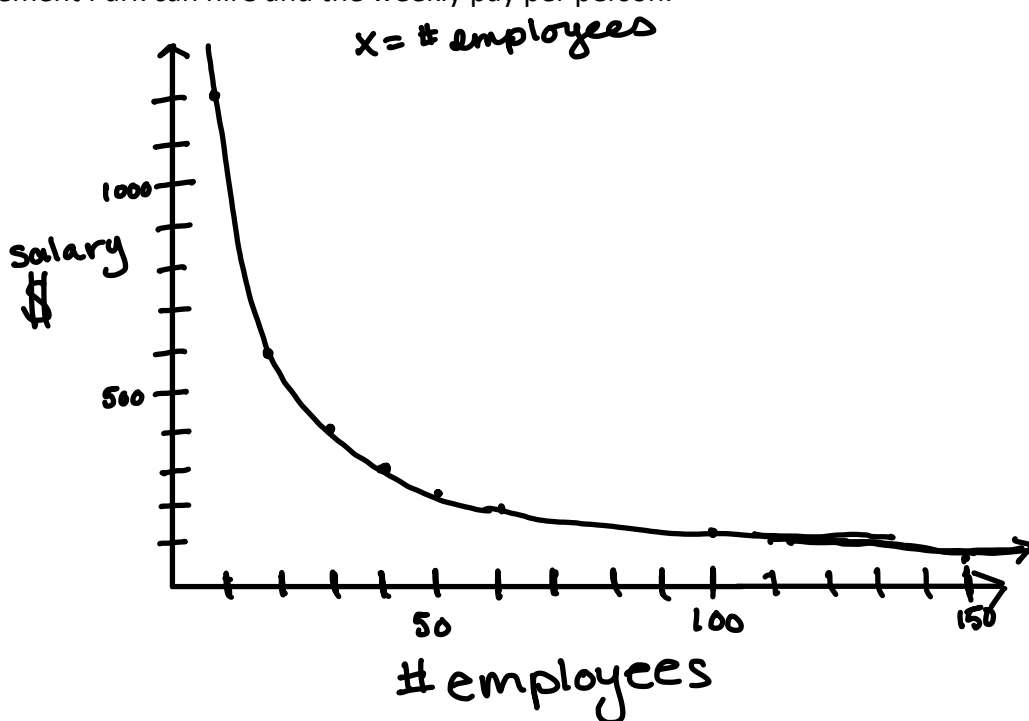
1. If Family Kingdom Amusement Park hired 60 people, how much would each person make per week? Justify your answer.

$$\frac{12000}{60} = 200 \quad \$200 \text{ per week}$$

2. Create an equation, table, and graph that models the relationship between the number of people that Family Amusement Park can hire and the weekly pay per person.

$$y = \frac{12000}{x}$$

# X employees	y salary
10	1200
20	600
30	400
40	300
50	240
60	200
100	120
120	100
150	80
200	60
1200	10



From previous years the owners at Family Kingdom Amusement Park have realized that the more money they advertise for pay per week, the more applicants they will receive. Two years ago the owners advertised this seasonal part-time work as having a weekly salary of \$205 and they received 40 job applications. Last year they advertised a weekly salary of \$220 and they received 50 job applications.

3. Create an equation, table and graph to model the relationship between the weekly salary advertised and the number of job applications the owners will receive.

x Salary	$A(x)$ # applicants
205	40
220	50
225	53.333

$$+15 \left[\begin{array}{l} 205 \\ 220 \\ 225 \end{array} \right] \begin{array}{l} 40 \\ 50 \\ 53.333 \end{array} + 10$$

$$y - 50 = \frac{10}{15}(x - 220)$$

$$y - 50 = \frac{2}{3}(x - 220)$$

$$y - 50 = \frac{2}{3}x - \frac{440}{3}$$

$$y = \frac{2}{3}x - \frac{440}{3} + \frac{150}{3}$$

$$y = \frac{2}{3}x - \frac{290}{3}$$

$$A(x) = \frac{2}{3}x - \frac{290}{3}$$

4. How much should the owners at Family Kingdom Amusement Park advertise as the weekly pay if they want for the number of job applications to be the same as the number of people they can hire? If the owners choose to advertise at this amount of pay per week, how many applications will they receive? Justify your answer.

$$\# \text{ applicants} = \# \text{ employees}$$

$$x = \text{Salary}$$

$$\frac{2}{3}x - \frac{290}{3} = \frac{12000}{x}$$

$$\frac{2}{3}x^2 - \frac{290}{3}x = 12000$$

$$2x^2 - 290x - 36000 = 0$$

$$x^2 - 145x - 18000 = 0$$

$$x = 225 \quad x = \cancel{80}$$

5. The owners at Family Kingdom Amusement Park want to have more applicants than people that they can actually hire, so that they can choose the best workers from the pool of applicants. Write an inequality that can be solved to find the weekly salary that the owners should advertise to make sure that they receive more applications than people that they can hire. Then, use tables and graphs to solve the inequality so that the owners know how much they can advertise to ensure that they receive more applicants than people they can actually hire.

The company should offer
greater than \$225 per week
to gain more applicants.

6. Make a recommendation to the owners about how much they should advertise as the weekly salary. Explain why your recommendation is the owner's best option. Make sure that you let them know how many job applications they should expect, how many people they can hire, and the total cost per week for salaries of all seasonal workers.

7. You just solved a system of equations that involved a linear equation and an inverse variation equation, both graphically and using tables. How would you solve the following system?

$$y = \sqrt{x}$$

$$x - y = 6$$

$$x - 6 = y$$

$$\begin{aligned} (\sqrt{x})^2 &= (x-6)^2 \\ x &= x^2 - 12x + 36 \\ 0 &= x^2 - 13x + 36 \\ 0 &= (x-9)(x-4) \\ x &= 9 \quad x = 4 \end{aligned}$$

$$\begin{aligned} \sqrt{9} &= 9-6 & (9,3) \\ 3 &= 3 \checkmark \end{aligned}$$

$$\begin{aligned} \sqrt{4} &= 4-6 \\ 2 &= -2 \text{ No} \\ 4 &\text{ is an extraneous solution} \end{aligned}$$

8. Solve the following systems of equations.

a. $y = \sqrt{x}$ $y = \sqrt{4} = 2$ $(4,2)$
 $y = \sqrt{9} = 3$ $(9,3)$

$$x - y = 6$$

$$x - 6 = y$$

$$(x-6)^2 = (\sqrt{x})^2$$

$$x^2 - 12x + 36 = x$$

$$x^2 - 13x + 36 = 0$$

$$(x-4)(x-9) = 0$$

$$x = 4 \quad x = 9$$

b. $y = \frac{-1}{x}$

$$y = x+2 = -1+2 = 1$$

$$-\frac{1}{x} = x+2 \quad (-1,1)$$

$$-1 = x^2 + 2x$$

$$0 = x^2 + 2x + 1$$

$$0 = (x+1)^2$$

$$x = -1$$

c. $y = \sqrt{4x+4}$

$$y = 0.5x+2$$

$$(0,2) \text{ and } (8,6)$$

$$\begin{aligned} \sqrt{4x+4} &= .5x+2 \\ (2\sqrt{4x+4})^2 &= (x+4)^2 \\ 4(4x+4) &= x^2+8x+16 \\ 16x+16 &= x^2+8x+16 \\ 0 &= x^2-8x \\ 0 &= x(x-8) \\ x &= 0 \quad x = 8 \end{aligned}$$

d. $y = \sqrt{x+3}$

$$y = -2x+4$$

$$(\sqrt{x+3})^2 = (-2x+4)^2$$

$$x+3 = 4x^2 - 16x + 16$$

$$0 = 4x^2 - 17x + 13$$

$$0 = (4x-13)(x-1)$$

$$x = \frac{13}{4}$$

$$x = 1$$

extraneous

$$(1,2)$$

e. $y = \frac{5}{x}$

$$y = -3x+1$$

$$\frac{5}{x} = -3x+1$$

$$5 = -3x^2 + x$$

$$3x^2 - x + 5 = 0$$

no solutions

$$\begin{aligned} 9 - 4(3)(5) \\ 9 - 60 \\ -51 \end{aligned}$$

f. $y = \sqrt{x+1}$

$$y = \sqrt{-x+7}$$

$$\sqrt{x+1} = \sqrt{-x+7}$$

$$x+1 = -x+7$$

$$2x = 6$$

$$x = 3$$

$$(3,2)$$