WORKSHEET 9 - SCHOOL FAIR

The students at Geometreetown Middle School are getting ready for the school spring fair, it is scheduled from 10 am to 4 pm. They are trying to decide between a dunk tank and a bounce house.

The dunk tank costs $700 and adds an additional $30 per hour for rentals over 5 hours. The bounce house charges $450 and an additional $90 per hour for rentals over 3 hours. Both rental companies prorate their hourly fees. For example, returning the bounce house 10 minutes into the next hour, or renting it for 5 hours and 10 minutes would result in 1/6 of the hourly fee being charged.

What is the price difference for renting the dunk tank and renting the bounce house? Is there a length of time when the price would be the same?

MATH STANDARDS ALIGNMENT

CCSS.MATH.CONTENT.8.F.B.4

Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Personal Finance Big Ideas:
Cost/Benefit Analysis; What is Money

METHOD 1: NOTICE & WONDER

I started by noticing what I could about the problem:

- The spring fair is from 10 am – 4 pm, 6 hours long
- The students are deciding if they want a dunk tank or a bounce house
- The dunk tank costs $700 for 5 hours and $30 each hour after that
- The bounce house costs $450 for 3 hours and $90 each hour after that
- The base price for each item is different
- If you rented either item for less than an hour (after you paid the base price) you'd pay a portion of the hourly charge.
- The bounce house is great in any weather.
- The dunk tank might unkind if the weather is really chilly.

I also wondered:

- Would more people come to the fair (and spend more money) if they chose the dunk tank or the bounce house?
- Which one would cost more for the fair?
- When would the cost be the same?
- Why is the base price for the bounce house so much lower?

I thought it would be useful to make a chart to solve this:

Time	Dunk Tank	Bounce House
10:00 - 11:00	$700.00	$450.00
11:00 - 11:00	$700.00	$450.00
12:00 - 1:00	$700.00	$450.00
1:00 - 2:00	$700.00	$540.00
2:00 - 3:00	$700.00	$630.00
3:00 - 4:00	$730.00	$720.00

Wow, the cost is close! The dunk tank is only $10 more for the length of the fair.

It looks like if there is a time when they cost the same amount it will be after 4 pm. I can figure that out either by making smaller intervals or using algebra. I'll do it with smaller intervals and excel.

I know the dunk tank is $30 for an additional hour, so per minute it would be $30 per hour divided by 60 minutes per hour, or $0.50, 50 cents, per minute.

I know the bounce house is $90 for an additional hour, so per minute it would be $90 per hour divided by 60 minutes per hour, or $1.50 per minute.

I did notice the bounce house is 3 times as much per minute as the dunk tank!

If I check 5 minute intervals I can calculate the cost for 5 min of dunk tank and for 5 min of bounce house:

Dunk Tank: 5 min * $0.50 = $2.50

Bounce House: 5 min * $1.50 = $7.50

I started at 3 pm just because I sort of wanted to see the pattern and how quickly they got close in terms of cost:

Time	Dunk Tank	Bounce House	Difference
3:00	$700.00	$630.00	$70.00
3:05	$702.50	$637.50	$65.00
3:10	$705.00	$645.00	$60.00
3:15	$707.50	$652.50	$55.00
3:20	$710.00	$660.00	$50.00
3:25	$712.50	$667.50	$45.00
3:30	$715.00	$675.00	$40.00
3:35	$717.50	$682.50	$35.00
3:40	$720.00	$690.00	$30.00
3:45	$722.50	$697.50	$25.00
3:50	$725.00	$705.00	$20.00
3:55	$727.50	$712.50	$15.00
4:00	$730.00	$720.00	$10.00
4:05	$732.50	$727.50	$5.00
4:10	$735.00	$735.00	$0.00

At 4:10 the cost will be the same!

METHOD 2: ALGEBRAIC APPROACH

Let x = the number of hours of rental

The Dunk Tank rental company charges a base fee of $700, and their hourly rate of $30 starts only after 5 hours, so if x is the number of hours the dance lasts, x - 5 is the number of hours for which the dunk tank rental company will charge the $30 rate. Thus, their cost for x hours is given by:

$$700 + 30(x - 5)$$

The Bounce House rental company charges a base fee of $450, and their hourly rate of $90 starts only after 3 hours, so if x is the number of hours the dance lasts, x - 3 is the number of hours for which the Bounce House rental company will charge the $80 rate. Thus, their cost for x hours is given by:

$$450 + 90(x - 3)$$

To find the cost of each, we can set x = 6:

For the Dunk Tank:

Total Cost = 700 + 30(x - 5)

Total Cost = 700 + 30(6 - 5)

Total Cost = 700 + 30(1)

Total Cost = $730

For the Bounce House:

Total Cost = 450 + 90(x - 3)

Total Cost = 450 + 90(6 - 3)

Total Cost = 450 + 90(3)

Total Cost = 450 + 270

Total Cost = $720

So the cost of the Dunk Tank would be $730 and the cost of the Bounce House would be $720 for a Spring Fair from 10 am – 4 pm. That's really only a $10 difference between the two!

To find the time when the costs are the same, set the two cost expressions equal and solve for x:

$700 + 30(x - 5) = 450 + 90(x - 3)$

$700 + 30x - 150 = 450 + 90x - 270$

$30x + 550 = 90x + 180$

$370 = 60x$

$6.16667 = x$

0r $6\frac{1}{6} = x$

The cost will be equal when 6-1/6 hours have passed. To figure out how many minutes that is, I need to figure out how many minutes 1/6 of an hour is. One hour is 60 minutes, so 10 minutes is 1/6 of an hour.

So, the cost will be the same when 6 hours and 10 minutes have passed, since the fair starts at 10 am, that means the cost will be the same at 4:10 pm.