

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*

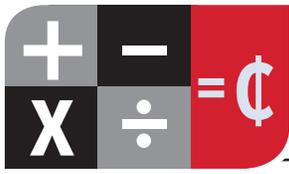
### METHOD 1: NOTICE & WONDER

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.

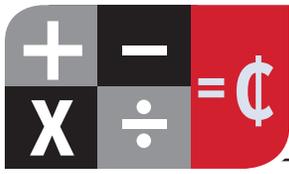
I did notice the bounce house is 3 times as much per minute as the dunk tank!

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

$$\text{Dunk Tank: } 5 \text{ min} * \$0.50 = \$2.50$$

$$\text{Bounce House: } 5 \text{ min} * \$1.50 = \$7.50$$





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

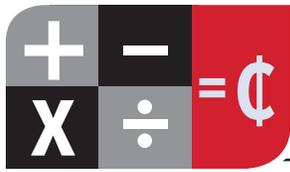
The Dunk Tank rental company charges a base fee of \$700, and their hourly rate of \$30 starts only after 5 hours, so if  $x$  is the number of hours the dance lasts,  $x - 5$  is the number of hours for which the dunk tank rental company will charge the \$30 rate. Thus, their cost for  $x$  hours is 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 \$90 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:

$$\text{Total Cost} = 700 + 30(x - 5)$$

$$\text{Total Cost} = 700 + 30(6 - 5)$$

$$\text{Total Cost} = 700 + 30(1)$$

$$\text{Total Cost} = \$730$$

For the Bounce House:

$$\text{Total Cost} = 450 + 90(x - 3)$$

$$\text{Total Cost} = 450 + 90(6 - 3)$$

$$\text{Total Cost} = 450 + 90(3)$$

$$\text{Total Cost} = 450 + 270$$

$$\text{Total Cost} = \$720$$

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:

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

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

$$30x + 550 = 90x + 180$$

$$370 = 60x$$

$$6.16667 = x$$

Or  $6 \frac{1}{6} = x$

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.

