**Break-Even Analysis: Popcorn**

The business club is going to sell popcorn at hockey games. Since they are astute business men and business women, they know that they will not make a profit right away because they have to pay the cost of buying a popcorn machine. They need to know how many bags of popcorn they must sell in order to cover the set-up costs. In other words, what is the **break-even point** for their popcorn business?

The red and glass popcorn carts often seen at carnivals and fairs costs $450. This is the **fixed cost**. Regardless of the number of bags of popcorn they make and sell, the machine cost will not change.

1. The popcorn, butter, salt, and serving bags cost $15 for every 100 bags of popcorn. What is the cost per bag for these consumables?

The **variable cost** changes depending on how many bags of popcorn they make. The more popcorn they make, the more they spend on popcorn, butter, salt and bags. The variable cost is $0.15 times the number of bags of popcorn.

The **total cost** is the variable cost plus the fixed cost.

$$Total Cost=Variable Cost+Fixed Cost$$

1. Write an equation for the Total Cost as a function of the number of bags of popcorn made. Use the notation *C*(*x*) for total cost, and let *x* be the number of bags of popcorn they make.

Each bag of popcorn sells for $1.00. The **revenue** is the amount of money they receive from selling bags of popcorn. If they sell 20 bags of popcorn, they will receive $20, since each bag sells for $1. The revenue they take in is the price per bag of popcorn multiplied by the number of bags of popcorn sold.

$$Revenue=(Price per Item)(Number of Items)$$

1. Write an equation for the Revenue as a function of the number of bags of popcorn sold. Label the revenue function *R*(*x*).

The **break-even point** occurs when the amount of money they receive from selling popcorn is equal to the amount of money they spent to make the popcorn. It is when Revenue = Total Cost. The break-even point tells how many items they must create and sell in order to recover their expenses.

1. Take the Total Cost and Revenue functions that you developed above, and sketch the graph of the two functions on one coordinate plane. Label the axes appropriately.



1. Estimate the break-even point graphically.
2. To find the break-even point algebraically, write R(*x*) = C(*x*).
3. Solve the equation R(*x*) = C(*x*) for *x*.
4. Check your graphical estimate with your algebraic solution. Explain any difference.
5. Now that you found *x*, what does it mean in terms of the popcorn business?
6. The business will earn a profit when revenue is greater than total cost.
	1. Use an inequality to represent the number of bags of popcorn that must be made and sold to make a profit.
	2. Show on a number line the number of bags of popcorn that must be made and sold to make a profit?

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