In most cities cab fares are regulated and standardized. In Linearcity, there are two competeing cab companies and they have the following 2 fare structures:

Company A: $1.75 base price with $0.50 per each additional 1/5 of a mile.

Company B: $2.70 base price with a $0.23 per each additional 1/10 of a mile.

Can you help the city residents develop a rule that helps them know when they should call each cab company?

Note: The cost of each additional mile is prorated – so if you travel 1/10 of a mile with Company A, would be $0.25.

MATH STANDARDS ALIGNMENT

CCSS.MATH.CONTENT.8.EE.C.7
Solve linear equations in one variable.

CCSS.MATH.CONTENT.8.EE.C.8
Analyze and solve pairs of simultaneous linear equations.

Personal Finance Big Ideas:
Cost/Benefit Analysis

METHOD 1: MAKE A GRAPH

Both plans have an initial base fee, so you pay that no matter how far you travel. I am thinking that for certain distances, one cab company will be cheaper and others the other will. I think if I could graph these two price models I could see when each one makes sense.

For Company A, I know the base price is $2.50 and that for each additional 1/5 of a mile it will be $0.50.

Let x = total miles traveled

I can then see that the equation will be:

Cab Fare = Base price + 50 cents per additional 1/5 of a mile

Cab Fare = 1.75 + (5x)(0.50)

y = 1.75 + (5x)(0.50)

For Company B, I know the base price is $2.70 and that for each additional 1/10 of a mile it will be $0.23.

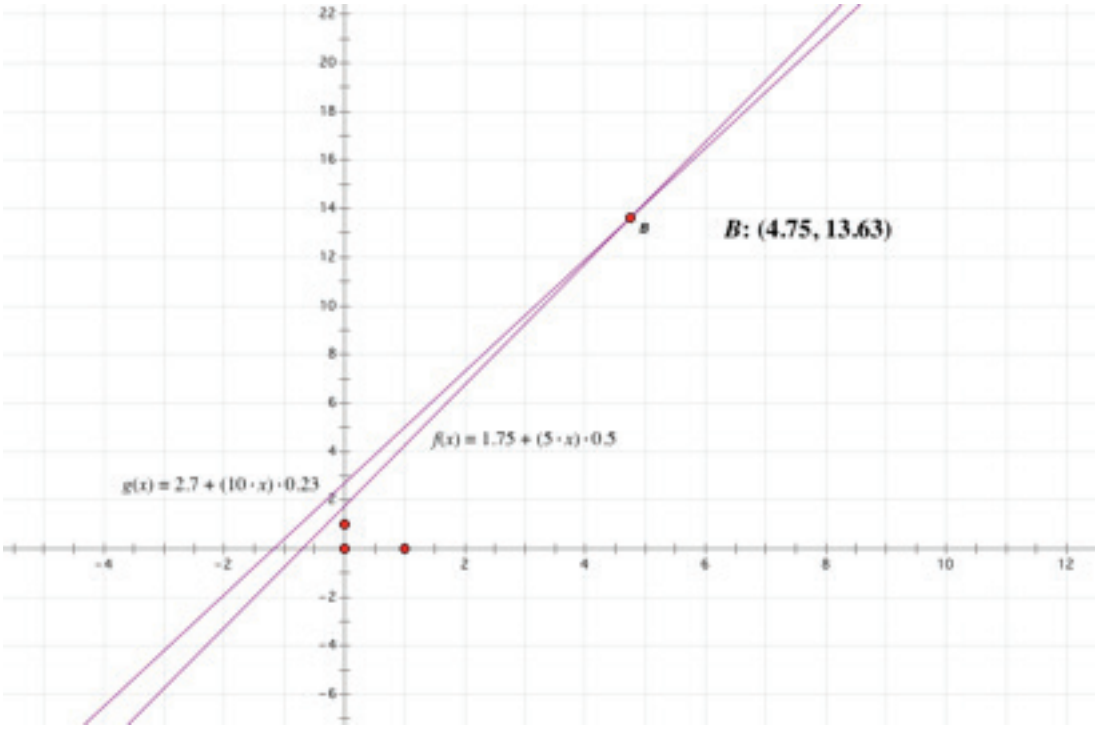
Let x = total miles traveled

I can then see that the equation will be:

Cab Fare = Base price + 23 cents per additional 1/10 of a mile

Cab Fare = 2.70 + (10x)(0.23)

Graphing these two equations, I can graph them with distance traveled in miles on the x-axis and total cost of the fare on the y-axis:



I can see that the two graphs intersect at (4.75, $13.63). Initially, Company A is cheaper initially, but after 4.75 miles, Company B becomes cheaper. The rule I would give to cab riders in Linearcity would be that if there trip is 4.75 miles or less, they should use Company A, otherwise, they should use Company B.

METHOD 2: MAKE A MATHEMATICAL MODEL

To compare the plans I think I can make linear equations for each and then figure out their point of intersection. Company A has a base price of $1.75 for any amount of miles traveled and then 50 cents more for every 1/5 of a mile traveled. So I can see that if I travelled 1 mile it would cost me 1.75 + 5(0.50) = $4.25. So, I can take the number of miles traveled, multiply it by 5 (to get the number of 1/5s) and then multiply it by $0.50 to get the additional charge to add to the base price of $1.75. My equation would be, if x = number of miles traveled:

y = 1.75 + 5x(0.50)

y = 1.75 + 2.5x

Company B is similar, again, I can see that if I travelled 1 mile it would cost me 2.70 + 10(0.23) = $5.00. I will again let x = the miles traveled and my equation will be:

y = 2.70 + 10x(0.23)

y = 2.7 + 2.3x

I can see that initially, for distances like 1 mile, Company A is cheaper. I can figure out when they price is the same, and assume that after that, Company B would be cheaper.

$$1.75 + 5x(.25) = 2.70 + 10x(0.23)$$

$$1.75 + 2.5x = 2.70 + 2.3x$$

$$0.2x = 0.95$$

$$x = 4.75$$

So at 4.75 miles the cost is equal, and for distances over 4.75 miles, Company B will be less expensive. I would recommend to travellers in Linearcity that if they are travelling less than 4.75 miles, to use Company A, if their trip is longer than 4.75 miles to use Company B and if their trip is exactly 4.75