**Graphing Equations**

For your birthday you decide to take your friends to Boomers. The price of admission is $15.00. Complete a table that shows the total cost spent for various numbers of friends.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Friends** | 0 | 1 | 2 | 4 | 6 |
| **Cost** | $0 | $15 |  |  |  |

To see all the different possibilities, please graph this information below. First, label the y- and x-axis (Cost or Friends). Then, choose a scale for the y-axis.



1. Using the graph, how much would it cost to bring 9 friends to Boomers?
2. If you had $125.00 to spend on your birthday, how many friends could you bring, including yourself?
3. Write an equation using the variable *c* for cost and *f* for friends.
4. Use the equation to find the cost of 12 friends. Show your work.

**Stacking Cups Algebra**

In the stacking cups activity, you found that the height of four cups was 14 cm. The base cup was 8cm high and every time you added another cup, 2 cm was added to the total height.

1. Complete the table below for the number of cups and height of the stack.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Cups** | 0 | 1 | 2 | 4 | 17 |  | 75 |
| **Height** | 0 | 8 | 10 | 14 |  | 50 |  |

2. If you were working at a cup factory and shipping cups you would not want to always calculate this every time by hand. Write an equation to find the height of any number of cups.

3. Graph the information from the table above. Remember to label (cups and height) and scale your x- and y-axis.





In the previous problem the height of the first cup was **fixed**, meaning it did not change. The height of the stacked cups was **variable,** meaning it depended on the number of cups that were stacked. In a linear equation there is often a part of the problem that is **fixed** (doesn’t change no matter how many/much of the variable you have) and a part that is **variable** (depends on the quantity of the variable). See if you can identify the **fixed** and **variable** costs in the problem below…

**S**

andi recently signed up for long distance telephone service from Phones-R-Us. Phones-R-Us charges $4.00 per month flat rate, plus $.10 per minute of long distance calling.

In this situation, what is the **fixed cost**? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 In this situation, what is the **variable cost**? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Complete the following table to determine the charges that Sandi would pay for various minutes of long distance calling by substituting the values in the table for *m* into the formula and calculating the value for *c*.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Monthly Minutes (*m*) | 0 | 2 | 8 | 14 | 20 |
| Monthly Charge (*c*) |  |  |  |  |  |

2. What would the algebraic equation (or **formula**) for this situation be? (Use *m* to represent the number of monthly minutes of calls and *c* to represent the monthly charge in dollars.)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3. Graph these points below:

6

5

4

3

2

1

0

0 2 4 6 8 10 12 14 16 18 20

Monthly Minutes (*m*)

Monthly Charge in Dollars (*c*)

4. Connect the points you graphed above. You have just graphed a **linear****formula**. It is called *linear* because the graph forms a straight line.

5. What is the **starting point**? (If you make zero calls, what is the cost?)

6. What does the fourth point on your graph represent?

7. Use the formula to find the cost for 25 minutes of monthly calls. Does this value make sense according to your graph?

**K**im and Cyndi are starting a business tutoring students in math. They rent an office for $400 per month and have to pay the tutors $15 per hour for tutoring.

Let’s break this problem down step by step…

1. What are Kim and Cyndi’s **fixed costs per month?** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What are Kim and Cyndi’s **variable costs per month? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

3. Complete the following table to determine the expenses Kim and Cyndi would have for their tutoring company.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Hours of tutoring (*h*) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 80 | 100 |
| Total Expenses (*c*) |  |  |  |  |  |  |  |  |  |

1. Write an equation for the total **expenses (or costs (c))** of the tutoring business for any number of hours (h):

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Label and scale your graph below using the information above. Graph these points and connect the points.

6. What does the point (0, 400) represent?

7. How much would it cost if they tutored for 15 hours?

8. How much would it cost if they tutored for 550 hours? (Hint: use your formula)

Now that we know how much money they spend, we must now determine the amount of money the tutoring company makes… (turn page)

If they are able to charge students $40 per student per hour for tutoring, how long will it take for Kim and Cyndi to make a profit? A profit is the amount of money Kim and Cyndi will make after paying all their expenses. Answer the questions below to find out!

9. Now let’s fill out a table for the **revenue:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Hours of tutoring (*h*) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 80 | 100 |
| Total Revenue (*r*) |  |  |  |  |  |  |  |  |  |

10. Write an equation that expresses the **revenue,** or amount of money Kim and Cyndi receive for one student. Let **r** represent revenue and **h** represent the number of hours a student is tutored.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

11. Graph this information on the same graph on the previous page. Use a different color to represent the **revenue** line.

12. Look now to the graph. Find the **break-even point.** This is the point on the graph where the two lines cross…where the expenses exactly equal the revenue. What is the coordinate of the point?

 ( , )

 What do these two numbers represent?

Now you are able to answer the original question…

13. How long would it take Kim and Cyndi to make a profit?

We can use graphs to help us answer these types of problems if we graph a line for expenses and a graph for revenue. We can also use formulas to help us solve these types of questions.

**Profit = Revenue – Expenses**

If you determine what the revenue would be and the total expenses, you can subtract these numbers to find the profit.

14. If Kim and Cyndi paid $4,000 in expenses one month and brought in $5,200 in revenue, what was their profit for the month?

15. How much profit would they make after tutoring for 550 hours? (HINT: Use your answer from #5 and the revenue formula to help you.)

Using the skills you practiced on the previous pages, now it’s time to take a look at the costs of The Lantern Project. In this project you have made a kit which contains skewers, glue sticks, tissue paper, and a plastic bag. Use the information below to calculate how much it costs to make one of your kits (your **variable** cost).

|  |
| --- |
| **Skewers: $1.07 per package of 100** |
| **Glue Sticks: $10.76 per bag of 100 Our team used 170 glue sticks (52 students)** |
| **Tissue Paper: $12.38 for 400 sheets of tissue paper** |
| **Plastic Bag: 200 bags for $39.95** |
| **TOTAL VARIABLE COST PER LANTERN KIT:** |

After learning all about the needs of the villages around the world, you have decided to start your own nonprofit Lantern Kit making business to raise funds for The Lantern Project organization.

For each Lantern Kit you make you will have the variable cost calculated above. In addition, each month your Lantern business has other expenses (costs) as well: electricity, work space, band-aids for burnt fingers, internet, etc. These **fixed costs** total $25 per month.

In the table below, calculate the total expenses per month to operate your Lantern Kit making business:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of Lantern Kits | 0 | 1 | 5 | 10 | 20 | 30 | 50 |
| Total Monthly Expenses (Cost) |  |  |  |  |  |  |  |

Using the information above, write an equation to find the total cost per month for your Lantern Business. Use C to represent cost and L to represent the number of lanterns you make.

|  |
| --- |
| **TOTAL COST PER MONTH FOR L NUMBER OF LANTERNS:** |

Now using the table on the previous page graph this information on the graph below. Be sure to scale and label your axes.

**Lantern Business Profit Analysis**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
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**Revunue of Lantern Kit**

One thing business owners need to decide when starting out is how much to charge for their product. It is important to price *based on quality of the product.* Use the table below to determine the price you think your kit is worth. Circle the box in each row that you feel represents the quality of your lantern/kit.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **$10** | **$15** | **$20** |
| **Craftsmanship of Lantern** | Average quality. Wrinkling of tissue, unclean edges, excess glue, bleeding of color | Strong quality. Smooth tissue with a little wrinkling, clean edges, and professional finishes | Exceptional quality. Smooth tissue, clean edges, professional finishes and attention to detail. |
| **Detail of shape** | Less than 10 faces | 10-12 faces | 13+ faces |
| **Advertisement page** | Some typos, lots of white space on page, no border or simple border, or unclear photo | Clear photo, creative border, little white space, no typos | Creative border, no typos, clear image, everything centered on page, fill the space, overall professionalism |
| **Persuasive paragraphs** | Few facts included in writing piece, unclear structure, typos | Some facts, structure of paragraphs mostly clear, no typos | Clear beginning, middle, and end, no typos, includes facts and writer’s voice |

**Price you will charge per lantern:\_\_\_\_\_\_\_\_\_\_\_\_** (if needed find the average of the prices)

**Explain how you determined this price? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Use this price to determine the Revenue for the given number of kits you could sell:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Number of Lanterns Made | 0 | 1 | 5 | 10 | 20 | 30 | 50 |
| Total Monthly Revenue |  |  |  |  |  |  |  |

Now write an equation for the *Revenue* your business will make each month for any number of lanterns. Use R for revenue and L for number of lanterns.

|  |
| --- |
| **TOTAL COST PER MONTH FOR L NUMBER OF LANTERNS:** |

Now graph this information on the same graph you used for the Expenses equation. Use a different color pencil to distinguish the two equations.

Circle on your graph your **break-even point.**

How many lanterns would you need to sell to break-even? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_