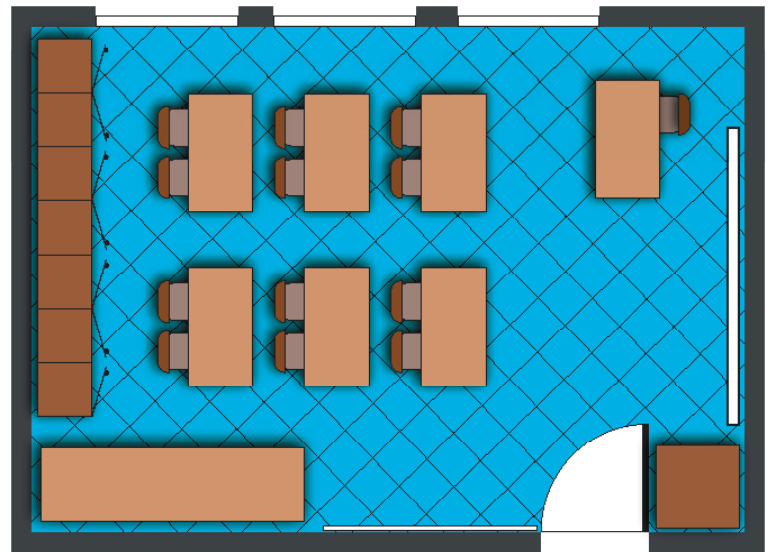




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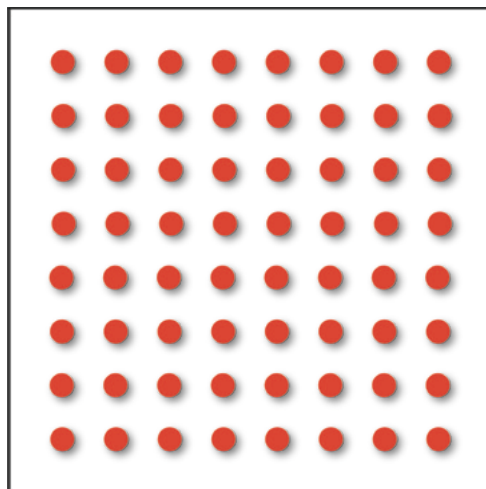
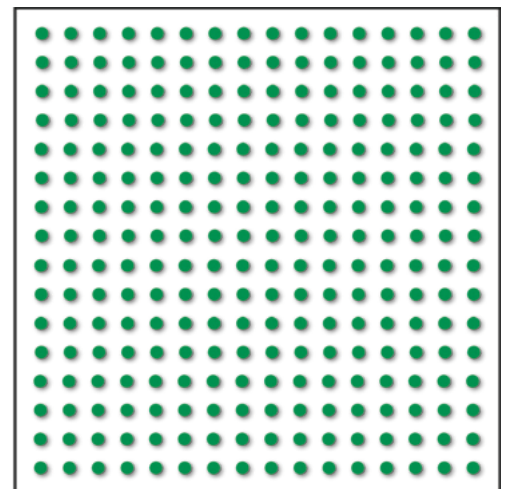
Putting It All Together

Student Workbook



estimate pencil quantity

Classroom Floor Plan



Dot Density

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Putting it All Together

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Putting it All Together
Student Workbook
Core Knowledge Mathematics™

Lesson 1: Planning Recipes

Let’s choose some recipes for a restaurant.

1.1: A Recipe for Your Restaurant

Imagine you could open a restaurant.

- 1. Select a recipe for a main dish you would like to serve at your restaurant.
- 2. Record the amount of each ingredient from your recipe in the first two columns of the table. You may not need to use every row.

ingredient	amount	amount per serving	calories per serving

- 3. How many servings does this recipe make? Determine the amount of each ingredient in one serving, and record it in the third column of the table.

4. Restaurants are asked to label how many calories are in each meal on their menu.

a. Use the nutrition information to calculate the amount of calories from each ingredient in your meal, and record it in the last column of the table.

b. Next, find the total calories in one serving of your meal.

5. If a person wants to eat 2,000 calories per day, what percentage of their daily calorie intake would one serving of your meal be?

Grains

	mass (g)	calories	fat (g)	sodium (mg)
biscuits, refrigerated dough (1)	58	178	6.14	567
bread crumbs (1 oz)	28.35	112	1.5	208
cornmeal (1 c)	157	581	2.75	11
egg noodles (1 c)	38	146	1.69	8
hamburger or hotdog buns (1)	44	123	1.72	217
oats (1 c)	81	307	5.28	5
pasta (1 c)	91	338	1.37	5
pie crust, refrigerated (1)	229	1019	58.3	937
pita bread (1 oz)	28.35	8	0.34	152
quinoa (1 c)	170	626	10.32	8
ramen noodles (1 pkg)	81	356	14.25	1503
rice flour (1 c)	158	578	2.24	0
rice, brown (1 c)	185	679	5.92	9
rice, white (1 c)	185	675	1.22	9
saltine crackers (5)	14.9	62	1.29	140
taco shells (1)	12.9	61	2.81	42
tortillas (1)	49	146	3.71	364
wheat bread (1 slice)	29	79	1.31	137
wheat flour (1 c)	125	455	1.22	2
white bread (1 slice)	29	77	0.97	142

Vegetables

	mass (g)	calories	fat (g)	sodium (mg)
asparagus (1 c)	134	27	0.16	3
avocados (1 c)	150	240	22	10
bell peppers (1 c)	149	46	0.45	6
broccoli (1 c)	91	31	0.34	30
carrots (1 c)	128	52	0.31	88
cauliflower (1 c)	107	27	0.3	32
celery (1 c)	101	16	0.17	81
chives (1 tbsp)	3	1	0.02	0
corn (1 c)	145	125	1.96	22
cucumber (1 c)	133	16	0.21	3
green beans (1 c)	100	31	0.22	6
lettuce (1 c)	47	8	0.14	7
mushrooms (1 c)	70	15	0.24	4
onions (1 c)	160	64	0.16	6
peas, frozen (1 c)	134	103	0.54	145
potatoes ($\frac{1}{2}$ c)	75	59	0.11	14
spinach (1 c)	30	7	0.12	24
squash (1 c)	113	18	0.2	2
sweet potatoes (1 c)	133	114	0.07	73
tomatoes (1 c)	149	27	0.3	7

Fruit

	mass (g)	calories	fat (g)	sodium (mg)
apple juice (1 c)	248	114	0.32	10
apples (1 c)	110	53	0.14	0
bananas (1 c)	225	200	0.74	2
blueberries (1 c)	148	84	0.49	1
cantaloupe (1 c)	177	60	0.34	28
cherries (1 c)	138	87	0.28	0
cranberries, dried ($\frac{1}{4}$ c)	40	123	0.44	2
grapes (1 c)	151	104	0.24	3
lemon juice (1 c)	244	54	0.59	2
Mandarin oranges (1 c)	252	154	0.25	15
mangoes (1 c)	165	99	0.63	2
orange juice (1 c)	249	122	0.3	5
oranges (1 c)	180	85	0.22	0
peaches (1 c)	154	60	0.38	0
pears (1 c)	140	80	0.2	1
pineapple, canned (1 c)	181	109	0.2	2
pomegranate juice (1 c)	1249	134	0.72	22
raisins (1 c)	165	493	0.76	18
raspberries (1 c)	123	64	0.8	1
strawberries (1 c)	152	49	0.46	2

Meat

	mass (g)	calories	fat (g)	sodium (mg)
bacon (1 slice)	26	106	10.21	122
chicken thigh (1)	193	427	32.06	156
chicken, light meat (3 oz)	85	100	1.45	60
cob (3 oz)	85	61	0.17	93
crab (3 oz)	85	73	0.82	251
ground beef (4 oz)	113	375	33.9	75
ground turkey (4 oz)	113	172	9.44	80
halibut (3 oz)	85	77	1.13	58
ham (1 oz)	28.35	38	1.53	319
hot dogs (1)	51	141	12.33	498
lobster (1)	150	116	1.12	634
pepperoni (3 oz)	85	428	39.34	1345
pork sausage (1)	25	72	6.2	185
pork tenderloin (3 oz)	85	102	3	44
salmon (1 fillet)	108	373	12.34	55
shrimp (3 oz)	85	72	0.43	101
tofu ($\frac{1}{2}$ c)	126	98	5.25	15
trout (1 fillet)	79	111	4.88	40
tuna, canned (1 oz)	28.35	24	0.27	70
turkey (3 oz)	85	92	2.12	105

Nuts, Beans, and Seeds

	mass (g)	calories	fat (g)	sodium (mg)
almonds (1 c)	143	828	71.4	1
black beans (1 c)	240	218	0.7	331
cashews (1 oz)	28.35	157	12.43	3
chickpeas (1 c)	240	211	4.68	667
coconut (1 c)	80	283	26.8	16
fava beans (1 c)	256	182	0.56	1160
flaxseed (1 tbsp)	10.3	55	4.34	3
white beans (1 c)	262	299	1.02	969
kidney beans (1 c)	256	215	1.54	758
lentils (1 c)	192	676	2.04	12
lima beans (1 c)	164	216	0.72	85
macadamia nuts (1 c)	134	962	101.53	7
peanut butter (2 tbsp)	32	191	16.22	136
peanuts (1 oz)	28.35	166	14.08	116
pecans (1 c)	109	753	78.45	0
pinto beans (1 c)	240	197	1.34	643
pistachios (1 c)	123	689	55.74	1
pumpkin seeds (1 c)	129	721	63.27	9
sesame seeds (1 c)	144	825	71.52	16
sunflower seeds (1 c)	46	269	23.67	4

Dairy

	mass (g)	calories	fat (g)	sodium (mg)
almond milk (1 c)	262	39	2.88	186
blue cheese (1 oz)	28.35	100	8.15	325
butter (1 pat)	5	36	4.06	1
cheddar cheese (1 c)	132	533	43.97	862
coconut milk (1 c)	226	445	48.21	29
cream cheese (1 tbsp)	14.5	51	4.99	46
egg white (1)	33	17	0.06	55
egg yolk (1)	17	55	4.51	8
eggs (1)	50	72	4.76	71
evaporated milk (1 c)	252	270	5.04	252
whipping cream (1 c)	120	408	43.3	32
margarine (1 tbsp)	14.2	101	11.38	4
milk, skim (1 c)	245	83	0.2	103
milk, whole (1 c)	244	149	7.93	105
mozzarella cheese (1 c)	132	389	26.11	879
Parmesan cheese (1 c)	100	420	27.84	1804
sour cream (1 tbsp)	12	16	1.27	10
soy milk (1 c)	243	80	3.91	90
Swiss cheese (1 c)	132	519	40.91	247
yogurt (6 oz)	170	107	2.64	119

Sauces and Other Liquids

	mass (g)	calories	fat (g)	sodium (mg)
barbecue sauce (1 tbsp)	17	29	0.11	175
chicken broth (1 c)	249	15	0.52	924
cream of chicken soup ($\frac{1}{2}$ c)	126	113	7.27	885
gravy (1 c)	233	1	5.5	1305
honey (1 c)	339	25	0	14
Italian dressing (1 tbsp)	14.7	35	3.1	146
jams and jellies (1 tbsp)	20	56	0.01	6
ketchup (1 tbsp)	17	17	0.02	154
mayonnaise (1 tbsp)	15	103	11.67	73
mustard (1 tsp)	5	3	0.17	55
pasta sauce ($\frac{1}{2}$ c)	132	66	2.13	577
ranch dressing (1 tbsp)	15	64	6.68	135
salsa (2 tbsp)	36	10	0.06	256
soy sauce (1 tbsp)	16	8	0.09	879
vanilla extract (1 tsp)	4.2	12	0	0
vegetable broth (1 c)	221	11	0.15	654
vegetable oil (1 tbsp)	14	124	14	0
vinegar (1 tbsp)	15	3	0	0
water (1 fl oz)	29.6	0	0	1
Worcestershire sauce (1 tbsp)	17	13	0	167

Spices and Other Powders

	mass (g)	calories	fat (g)	sodium (mg)
baking powder (1 tsp)	4.6	2	0	488
baking soda (1 tsp)	4.6	0	0	1259
black pepper (1 tsp)	2.3	6	0.07	0
chicken bouillon (1 cube)	4.8	10	0.23	1152
chili powder (1 tsp)	2.7	8	0.39	77
cinnamon (1 tsp)	2.6	6	0.03	0
cocoa powder (1 c)	86	196	11.78	18
cornstarch (1 c)	128	488	0.06	12
cumin (1 tsp)	2.1	8	0.47	4
garlic (1 clove)	3	4	0.01	0.5
garlic powder (1 tsp)	3.1	10	0.02	2
onion powder (1 tsp)	2.4	8	0.02	2
onion soup mix (1 tbsp)	7.5	22	0.03	602
oregano (1 tsp)	1	3	0.04	0
paprika (1 tsp)	2.3	6	0.3	2
parsley (1 tsp)	0.5	1	0.03	2
powdered sugar (1 c)	120	467	0	2
salt (1 tsp)	6	0	0	2325
sugar (1 tsp)	2.8	11	0	0
taco seasoning (2 tsp)	5.7	18	0	411

Are you ready for more?

The labels on packaged foods tell how much of different nutrients they contain. Here is what some different food labels say about their sodium content.

- cheese crackers, 351 mg, 14% daily value
- apple chips, 15 mg, <1% daily value
- granola bar, 82 mg, 3% daily value

Estimate the maximum recommended amount of sodium intake per day (100% daily value). Explain your reasoning.

1.2: Health Claims

For a meal to be considered:

- “low calorie”—it must have 120 calories or less per 100 grams of food.
- “low fat”—it must have 3 grams of fat or less per 100 grams of food.
- “low sodium”—it must have 140 milligrams of sodium or less per 100 grams of food.

1. Does the meal you chose in the previous activity meet the requirements to be considered:

a. low calorie?

b. low fat?

c. low sodium?

Be prepared to explain your reasoning.

2. Select or invent another recipe you would like to serve at your restaurant that does meet the requirements to be considered either low calorie, low fat, or low sodium. Show that your recipe meets that requirement. Organize your thinking so it can be followed by others.

ingredient	amount per serving	calories per serving	fat per serving	sodium per serving

Lesson 2: Costs of Running a Restaurant

Let's explore how much the food will cost.

2.1: Introducing Spreadsheets

1. Type each formula into the cells of a spreadsheet program and press enter. Record what the cell displays. Make sure to type each formula exactly as it is written here.

	A	B	C	D
1	=40-32	=1.5+3.6	=14/7	=0.5*6

2.
 - a. Predict what will happen if you type the formula =A1*C1 into cell C2 of your spreadsheet.
 - b. Type in the formula, and press enter to check your prediction.
3.
 - a. Predict what will happen next if you delete the formula in cell A1 and replace it with the number 100.
 - b. Replace the formula with the number, and press enter to check your prediction.
4.
 - a. Predict what will happen if you copy cell C2 and paste it into cell D2 of your spreadsheet.
 - b. Copy and paste the formula to check your prediction.

2.2: Cost per Serving

1. Set up a spreadsheet with these column labels in the first row.

	A	B	C	D
1	ingredient	unit in recipe	amount in recipe	amount per serving
2				

- Type the information about the ingredients in your recipe into the first 3 columns of the spreadsheet.
- Type a formula into cell D2 to automatically calculate the amount per serving for your first ingredient.
- Copy cell D2 and paste it into the cells beneath it to calculate the amount per serving for the rest of your ingredients. Pause here so your teacher can review your work.

2. Add these column labels to your spreadsheet.

E	F	G	H
purchase price	purchase amount	purchase unit	cost per purchase unit

- Research the cost of each ingredient in your meal, and record the information in columns E, F, and G.
- Type a formula into cell H2 to automatically calculate the cost per purchase unit for your first ingredient.
- Copy cell H2, and paste it into the cells beneath it to calculate the cost per purchase unit for the rest of your ingredients.

3. Add these column labels to your spreadsheet.

I	J	K
conversion from purchase units to recipe units	cost per recipe unit	cost per serving

- Complete column I with how many of your recipe unit are in 1 of your purchase unit for each ingredient. For example, if your recipe unit was cups and your purchase unit was gallons, then your conversion would be 16 because there are 16 cups in 1 gallon.
 - Type a formula into cell J2 to calculate the cost per recipe unit for your first ingredient.
 - Type a formula into cell K2 to calculate the cost per serving for your first ingredient.
 - Compare formulas with your partner. Discuss your thinking. If you disagree, work to reach an agreement.
 - Copy cells J2 and K2, and paste them into the cells beneath them to calculate the cost per recipe unit and cost per serving for the rest of your ingredients.
4. Type a formula into the first empty cell below your last ingredient in column K to calculate the total cost per serving for all of the ingredients in your recipe. Record the answer here.

Lesson 3: More Costs of Running a Restaurant

Let's explore how much it costs to run a restaurant.

3.1: Are We Making Money?

1. Restaurants have many more expenses than just the cost of the food.
 - a. Make a list of other items you would have to spend money on if you were running a restaurant.
 - b. Identify which expenses on your list depend on the number of meals ordered and which are independent of the number of meals ordered.
 - c. Identify which of the expenses that are independent of the number of meals ordered only have to be paid once and which are ongoing.
 - d. Estimate the monthly cost for each of the ongoing expenses on your list. Next, calculate the total of these monthly expenses.

2. Tell whether each restaurant is making a profit or losing money if they have to pay the amount you predicted in ongoing expenses per month. Organize your thinking so it can be followed by others.

a. Restaurant A sells 6,000 meals in one month, at an average price of \$17 per meal and an average cost of \$4.60 per meal.

b. Restaurant B sells 8,500 meals in one month, at an average price of \$8 per meal and an average cost of \$2.20 per meal.

c. Restaurant C sells 4,800 meals in one month, at an average price of \$29 per meal and an average cost of \$6.90 per meal.

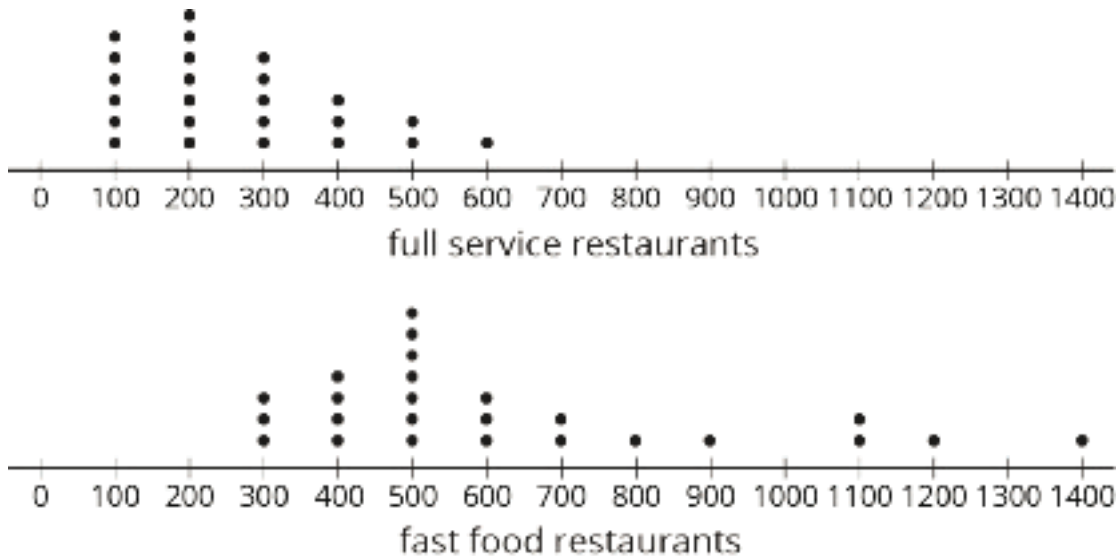
3. a. Predict how many meals your restaurant would sell in one month.

b. How much money would you need to charge for each meal to be able to cover all the ongoing costs of running a restaurant?

4. What percentage of the cost of the ingredients is the markup on your meal?

3.2: Disposable or Reusable?

A sample of full service restaurants and a sample of fast food restaurants were surveyed about the average number of customers they serve per day.



1. How does the average number of customers served per day at a full service restaurant generally compare to the number served at a fast food restaurant? Explain your reasoning.
2. About how many customers do you think your restaurant will serve per day? Explain your reasoning.

3. Here are prices for plates and forks:

	plates	forks
disposable	165 paper plates for \$12.50	600 plastic forks for \$10
reusable	12 ceramic plates for \$28.80	24 metal forks for \$30

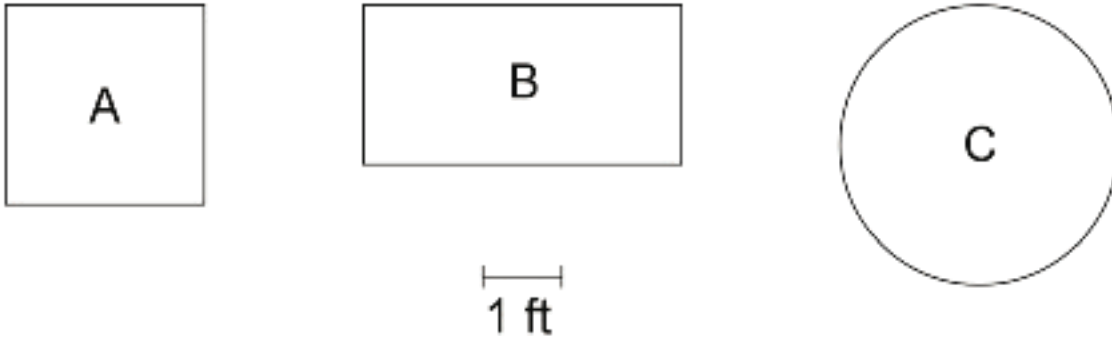
- a. Using your predicted number of customers per day from the previous question, write an equation for the total cost, d , of using disposable plates and forks for every customer for n days.
 - b. Is d proportional to n ? Explain your reasoning.
 - c. Use your equation to predict the cost of using disposable plates and forks for 1 year. Explain any assumptions you make with this calculation.
- 4.
- a. How much would it cost to buy enough reusable plates and forks for your predicted number of customers per day?
 - b. If it costs \$10.75 a day to wash the reusable plates and forks, write an expression that represents the total cost, r , of buying and washing reusable plates and forks after n days.
 - c. Is r proportional to n ? Explain your reasoning.
 - d. How many days can you use the reusable plates and forks for the same cost that you calculated for using disposable plates and forks for 1 year?

Lesson 4: Restaurant Floor Plan

Let's design the floor plan for a restaurant.

4.1: Dining Area

1. Restaurant owners say it is good for each customer to have about 300 in^2 of space at their table. How many customers would you seat at each table?



2. It is good to have about 15 ft^2 of floor space per customer in the dining area.
 - a. How many customers would you like to be able to seat at one time?
 - b. What size and shape dining area would be large enough to fit that many customers?

- c. Select an appropriate scale, and create a scale drawing of the outline of your dining area.

3. Using the same scale, what size would each of the tables from the first question appear on your scale drawing?
4. To ensure fast service, it is good for all of the tables to be within 60 ft of the place where the servers bring the food out of the kitchen. Decide where the food pickup area will be, and draw it on your scale drawing. Next, show the limit of how far away tables can be positioned from this place.
5. It is good to have at least $1\frac{1}{2}$ ft between each table and at least $3\frac{1}{2}$ ft between the sides of tables where the customers will be sitting. On your scale drawing, show one way you could arrange tables in your dining area.

Are you ready for more?

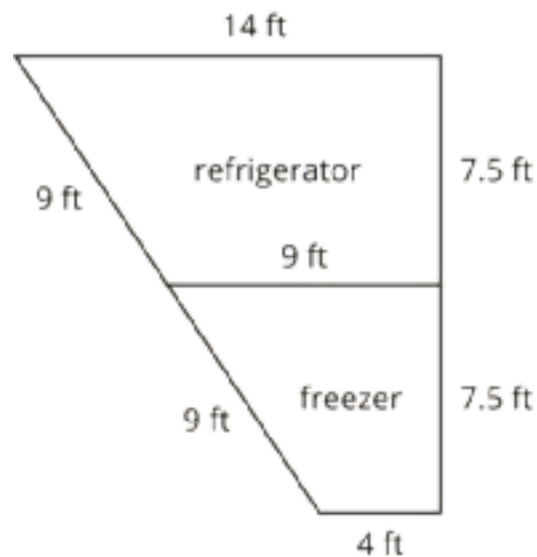
The dining area usually takes up about 60% of the overall space of a restaurant because there also needs to be room for the kitchen, storage areas, office, and bathrooms. Given the size of your dining area, how much more space would you need for these other areas?

4.2: Cold Storage

Some restaurants have very large refrigerators or freezers that are like small rooms. The energy to keep these rooms cold can be expensive.

- A standard walk-in refrigerator (rectangular, 10 feet wide, 10 feet long, and 7 feet tall) will cost about \$150 per month to keep cold.
- A standard walk-in freezer (rectangular, 8 feet wide, 10 feet long, and 7 feet tall) will cost about \$372 per month to keep cold.

Here is a scale drawing of a walk-in refrigerator and freezer. About how much would it cost to keep them both cold? Show your reasoning.

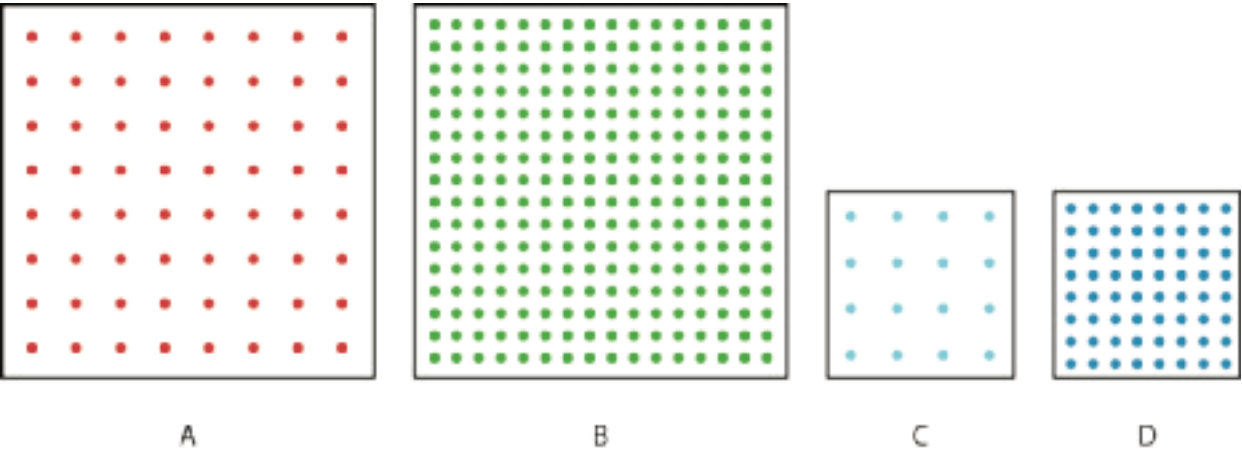


Lesson 5: How Crowded Is this Neighborhood?

Let’s see how proportional relationships apply to where people live.

5.1: Dot Density

The figure shows four squares. Each square encloses an array of dots. Squares A and B have side length 2 inches. Squares C and D have side length 1 inch.



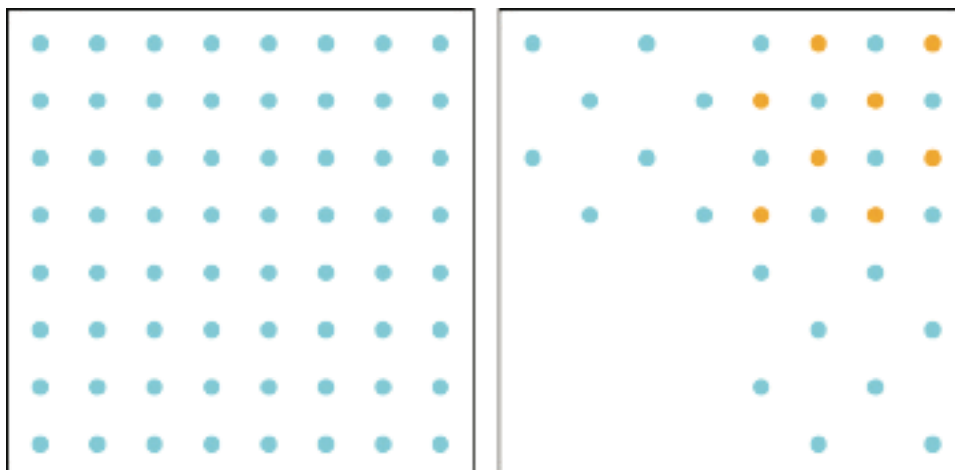
1. Complete the table with information about each square.

square	area of the square in square inches	number of dots	number of dots per square inch
A			
B			
C			
D			

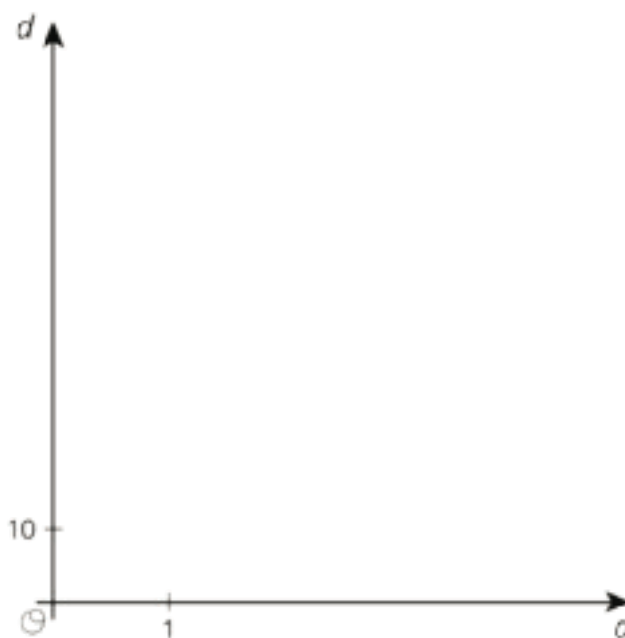
2. Compare each square to the others. What is the same and what is different?

5.2: Dot Density with a Twist

The figure shows two arrays, each enclosed by a square that is 2 inches wide.



1. Let a be the area of the square and d be the number of dots enclosed by the square. For each square, plot a point that represents its values of a and d .



2. Draw lines from $(0, 0)$ to each point. For each line, write an equation that represents the proportional relationship.
3. What is the constant of proportionality for each relationship? What do the constants of proportionality tell us about the dots and squares?

5.3: Housing Density

Here are pictures of two different neighborhoods.

This image depicts an area that is 0.3 kilometers long and 0.2 kilometers wide.



0.1 km

This image depicts an area that is 0.4 kilometers long and 0.2 kilometers wide.



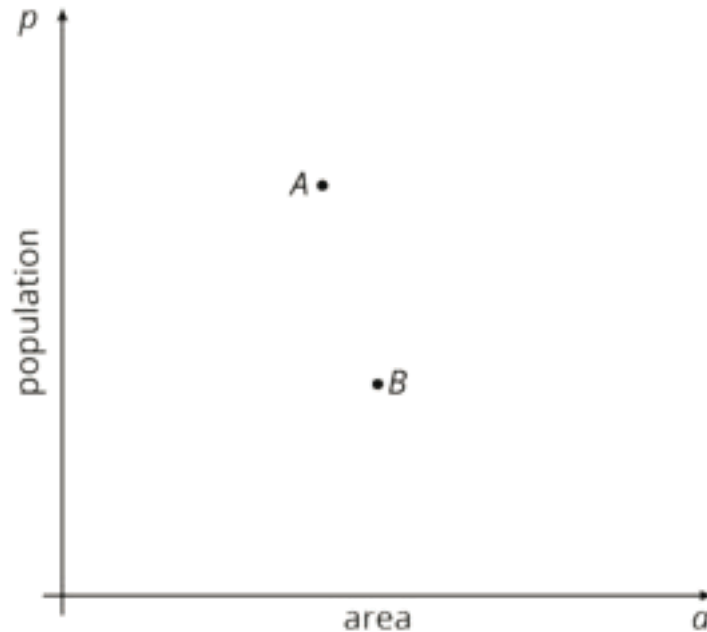
0.1 km

For each neighborhood, find the number of houses per square kilometer.

5.4: Population Density

- New York City has a population of 8,406 thousand people and covers an area of 1,214 square kilometers.
- Los Angeles has a population of 3,884 thousand people and covers an area of 1,302 square kilometers.

1. The points labeled A and B each correspond to one of the two cities. Which is which? Label them on the graph.



2. Write an equation for the line that passes through $(0, 0)$ and A . What is the constant of proportionality?
3. Write an equation for the line that passes through $(0, 0)$ and B . What is the constant of proportionality?
4. What do the constants of proportionality tell you about the crowdedness of these two cities?

Are you ready for more?

1. Predict where these types of regions would be shown on the graph:

- a. a suburban region where houses are far apart, with big yards
- b. a neighborhood in an urban area with many high-rise apartment buildings
- c. a rural state with lots of open land and not many people

2. Next, use this data to check your predictions:

place	description	population	area (km ²)
Chalco	a suburb of Omaha, Nebraska	10,994	7.5
Anoka County	a county in Minnesota, near Minneapolis/St. Paul	339,534	1,155
Guttenberg	a city in New Jersey	11,176	0.49
New York	a state	19,746,227	141,300
Rhode Island	a state	1,055,173	3,140
Alaska	a state	736,732	1,717,856
Tok	a community in Alaska	1,258	342.7

Lesson 6: Fermi Problems

Let's estimate some quantities.

6.1: How Old Are You?

What is your *exact* age at this moment?

6.2: A Heart Stoppingly Large Number

How many times has your heart beat in your lifetime?

6.3: All the Hairs on Your Head

How many strands of hair do you have on your head?

Lesson 7: More Expressions and Equations

Let's solve harder problems by writing equivalent expressions.

7.1: Tickets for the School Play

Student tickets for the school play cost \$2 less than adult tickets.

1. If a represents the price of one adult ticket, write an expression for the price of a student ticket.
2. Write an expression that represents the amount of money they collected each night:
 - a. The first night, the school sold 60 adult tickets and 94 student tickets.
 - b. The second night, the school sold 83 adult tickets and 127 student tickets.
3. Write an expression that represents the total amount of money collected from ticket sales on both nights.
4. Over these two nights, they collected a total of \$1,651 in ticket sales.
 - a. Write an equation that represents this situation.
 - b. What was the cost of each type of ticket?
5. Is your solution reasonable? Explain how you know.

7.2: A Souvenir Stand

The souvenir stand sells hats, postcards, and magnets. They have twice as many postcards as hats, and 100 more magnets than post cards.

1. Let h represent the total number of hats. Write an expression in terms of h for the total number of items they have to sell.
2. The owner of the stand pays \$8 for each hat, \$0.10 for each post card, and \$0.50 for each magnet. Write an expression for the total cost of the items.
3. The souvenir stand sells the hats for \$11.75 each, the postcards for \$0.25 each, and the magnets for \$3.50 each. Write an expression for the total amount of money they would take in if they sold all the items.
4. Profits are calculated by subtracting costs from income. Write an expression for the profits of the souvenir stand if they sell all the items they have. Use properties to write an equivalent expression with fewer terms.
5. The souvenir stand sells all these items and makes a total profit of \$953.25.
 - a. Write an equation that represents this situation.
 - b. How many of each item does the souvenir stand sell? Explain or show your reasoning.

7.3: Jada Crochets a Scarf

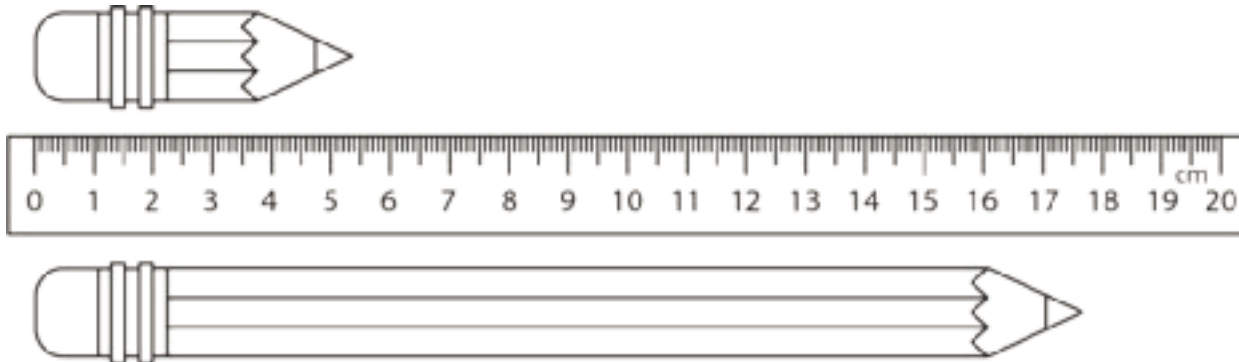
Basic crochet stitches are called single, double, and triple. Jada measures her average stitch size and sees that a “double crochet” stitch is not really twice as long; it uses $\frac{1}{2}$ inch less than twice as much yarn as a single crochet stitch. Jada’s “triple crochet” stitch uses 1 inch less than three times as much yarn as a single crochet stitch.

1. Write an expression that represents the amount of yarn Jada needs to crochet a scarf that includes 800 single crochet stitches, 400 double crochet stitches, and 200 triple crochet stitches.
2. Write an equivalent expression with as few terms as possible.
3. If Jada uses 5540 inches of yarn for the entire scarf, what length of yarn does she use for a single crochet stitch?

Lesson 8: Measurement Error (Part 1)

Let's check how accurate our measurements are.

8.1: How Long Are These Pencils?



1. Estimate the length of each pencil.
2. How accurate are your estimates?
3. For each estimate, what is the largest possible percent error?

8.2: How Long Are These Floor Boards?

A wood floor is made by laying multiple boards end to end. Each board is measured with a maximum percent error of 5%. What is the maximum percent error for the total length of the floor?

Lesson 9: Measurement Error (Part 2)

Let's check how accurate our calculations are.

9.1: Measurement Error for Area

Imagine that you measure the length and width of a rectangle and you know the measurements are accurate within 5% of the actual measurements. If you use your measurements to find the area, what is the maximum percent error for the area of the rectangle?

9.2: Measurement Error for Volume

1. The length, width, and height of a rectangular prism were measured to be 10 cm, 12 cm, and 25 cm. Assuming that these measurements are accurate to the nearest cm, what is the largest percent error possible for:
 - a. each of the dimensions?
 - b. the volume of the prism?
2. If the length, width, and height of a right rectangular prism have a maximum percent error of 1%, what is the largest percent error possible for the volume of the prism?

Lesson 10: Measuring Long Distances Over Uneven Terrain

Let's measure long distances over uneven terrain.

10.1: How Far Is It?

How do people measure distances in different situations? What tools do they use? Come up with at least three different methods and situations where those methods are used.

10.2: Planning a 5K Course

The school is considering holding a 5K fundraising walk on the school grounds. Your class is supposed to design the course for the walk.

1. What will you need to do to design the course for the walk?
2. Come up with a method to measure the course. Pause here so your teacher can review your plan.

10.3: Comparing Methods

Let's see how close different measuring methods are to each other. Your teacher will show you a path to measure.

1. Use your method to measure the length of the path at least two times.
2. Decide what distance you will report to the class.
3. Compare your results with those of two other groups. Express the differences between the measurements in terms of percentages.
4. Discuss the advantages and disadvantages of each group's method.

Lesson 11: Building a Trundle Wheel

Let's build a trundle wheel.

11.1: What Is a Trundle Wheel?

A tool that surveyors use to measure distances is called a trundle wheel.

1. How does a trundle wheel measure distance?
2. Why is this method of measuring distances better than the methods we used in the previous lesson?
3. How could we construct a simple trundle wheel? What materials would we need?



11.2: Building a Trundle Wheel

Your teacher will give you some supplies. Construct a trundle wheel and use it to measure the length of the classroom. Record:

1. the diameter of your trundle wheel
2. the number of clicks across classroom
3. the length of the classroom (Be prepared to explain your reasoning.)

Lesson 12: Using a Trundle Wheel to Measure Distances

Let’s use our trundle wheels.

12.1: Measuring Distances with the Trundle Wheel

Earlier you made trundle wheels so that you can measure long distances. Your teacher will show you a path to measure.

- 1. Measure the path with your trundle wheel three times and calculate the distance. Record your results in the table.

trial number	number of clicks	computation	distance
1			
2			
3			

- 2. Decide what distance you will report to the class. Be prepared to explain your reasoning.
- 3. Compare this distance with the distance you measured the other day for this same path.
- 4. Compare your results with the results of two other groups. Express the differences between the measurements in terms of percentages.

Lesson 13: Designing a 5K Course

Let's map out the 5K course.

13.1: Make a Proposal

Your teacher will give you a map of the school grounds.

1. On the map, draw in the path you measured earlier with your trundle wheel and label its length.
2. Invent another route for a walking course and draw it on your map. Estimate the length of the course you drew.
3. How many laps around your course must someone complete to walk 5 km?

13.2: Measuring and Finalizing the Course

1. Measure your proposed race course with your trundle wheel at least two times. Decide what distance you will report to the class.
2. Revise your course, if needed.
3. Create a visual display that includes:
 - A map of your final course
 - The starting and ending locations
 - The number of laps needed to walk 5 km
 - Any other information you think would be helpful to the race organizers

Are you ready for more?

The map your teacher gave you didn't include a scale. Create one.

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