MAT.04.PT.4.GROCE.A.074 Claim 4

Sample Item Id:	MAT.04.PT.4.GROCE.A.074
Title:	Grocery Store (GROCE)
Grade:	04
Primary Claim:	**Claim 4: Modeling and Data Analysis** Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.
Secondary Claim(S):	Claim 1: Concepts and Procedures Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.
Primary Content Domain	**Measurement and Data**
Secondary Content Domain(S):	Number and Operations Operations and Algebraic Thinking
Assessment Target(S):	4 A: Apply mathematics to solve problems arising in everyday life, society, and the workplace. 4 D: Interpret results in the context of a situation. 4 G: Identify, analyze and synthesize relevant external resources to pose or solve problems.
Standard(S):	4.OA.2, 4.OA.3, 4.NBT.4, 4.NBT.5, 4.NBT.6, 4.MD.2, 4.MD.3,4.NF.2, 3.NBT.2, 3.MD.3, 3.MD.6, 3.MD.7
Mathematical Practice(S):	1, 2, 3, 4, 5, 6, 7, 8
DOK:	3
Item Type:	PT
Score Points:	15
Difficulty:	H
How This Task Addresses The "Sufficient Evidence" For This Claim:	The student uses concepts of measurement and data, numbers and operations in base ten, and operations and algebraic thinking to accomplish tasks required of a grocery store manager opening a new store. The work is supported by calculations and explanations of reasoning.
Target-Specific Attributes (E.G., Accessibility Issues):	Accommodations may be necessary for students who have fine motor skills challenges and language processing challenges.
Stimulus/Source:	http://web.jjay.cuny.edu/~tflan/documents/101docs/FIS101OccupancyTypesandExits.pdf On the source, occupancy load for this type of building would be figured using gross floor area. In order to test the content intended, a comparable net floor area method for determining occupancy was used. This method produces an occupancy load that is similar to that of the original method but still within a reasonable range.
Notes:	Multi-part task
Task Overview:	The student assumes the role of a grocery store manager opening a new store. In a group and individually, the student completes tasks that lead up to the opening of the store. The

	student uses content from the domains of measurement and data, numbers and operations in base ten, and operations and algebraic thinking to accomplish these tasks.
Teacher Preparation / Resource Requirements:	Teacher preparation: Up to one week prior to administration of this task, students must be assigned a "prework" task that will be used to answer *Part C* of the task. The prework should be done as a class activity. In Session 1 of this performance task, *Part A* will also incorporate group work and will require the teacher to coordinate partner/group work for this part of the task, and then make sure *Part B* is completed independently. Session 2 will involve using the data that was collected and displayed during the prework in order to complete *Part C*, again followed by independent work in *Part D*. Resources: Materials/time to complete survey, blank grid paper to create the bar graph, and Store Layout grid paper (part of the assessment and included at the end of this sample).
Teacher Responsibilities During Administration:	Monitor individual student work; provide resources as necessary.
Time Requirements:	One prework session totaling no more than 60 minutes. One "mid-task" section incorporating group work that should total no more than 60 minutes. Two scored sections of the task totaling no more than 120 minutes.

Prework:

In preparation for this task, teachers must assign students the following task as a group/class activity at least 3 days prior to the administration of the performance task.

Teacher says: Students, together we must survey a total of 50 adults about the times they usually shop in a grocery store. Tonight's assignment is for each of you to ask two adults to answer this question, "During which part of the day do you usually shop for groceries? In the morning, afternoon, or evening"? Tomorrow we will collect all or your results and use the data to make a bar graph.

The next day, the teacher needs to facilitate the collection of all the data into a central location (like a white board) for students to be able to access the data in order to construct a bar graph within a smaller group (3-4 students). The teacher will generate additional data for the data set so it reflects exactly 50 surveyed adults.

Teacher says: Work in your assigned groups to use the information we collected to create a bar graph that displays the number of adults that we surveyed who shop during each of the three parts of the day (morning, afternoon, evening).

The teacher needs to provide grid paper and materials needed to create the bar graphs. A whole class discussion should occur after each group makes their bar graph, and the class should decide on the best display to use after sharing their work. The final "agreed-upon" bar graph will need to be copied and given out to students in order to complete *Part D* of the upcoming performance task. Have copies ready to hand out to each student at the appropriate time. A copy of this bar graph will also need to be included with student tasks that are turned in for scoring, so data used in *Part D* can be verified.

Preparing to Open a New Grocery Store

You are the manager for a new grocery store. The grocery store has been built, but it is not ready to open yet. Before the grocery store can open, the list of tasks below must be completed.

1. The store layout must be planned.
2. The pricing of different items must be set.
3. A plan for the number of workers at each time of day must be made.

[*Part A* should be completed as group work. Allowing the teacher/test administrator to read aloud this part of the task and facilitate the group work is desirable, but should be determined after piloting. A floor layout grid paper should be distributed to all students prior to starting the task.]

Part A

Store Layout

The floor of the store is a rectangle with a width of 30 yards and a length of 50 yards. The shapes shown below represent the top views of a shelf, a refrigerator, and a register area. These shapes must be arranged on the floor layout. The area not covered by these shapes will be the area customers use to walk around the store.

Each shelf measures 3 yards by 7 yards.

 = Shelf

Each refrigerator measures 3 yards by 9 yards.

 = Refrigerator

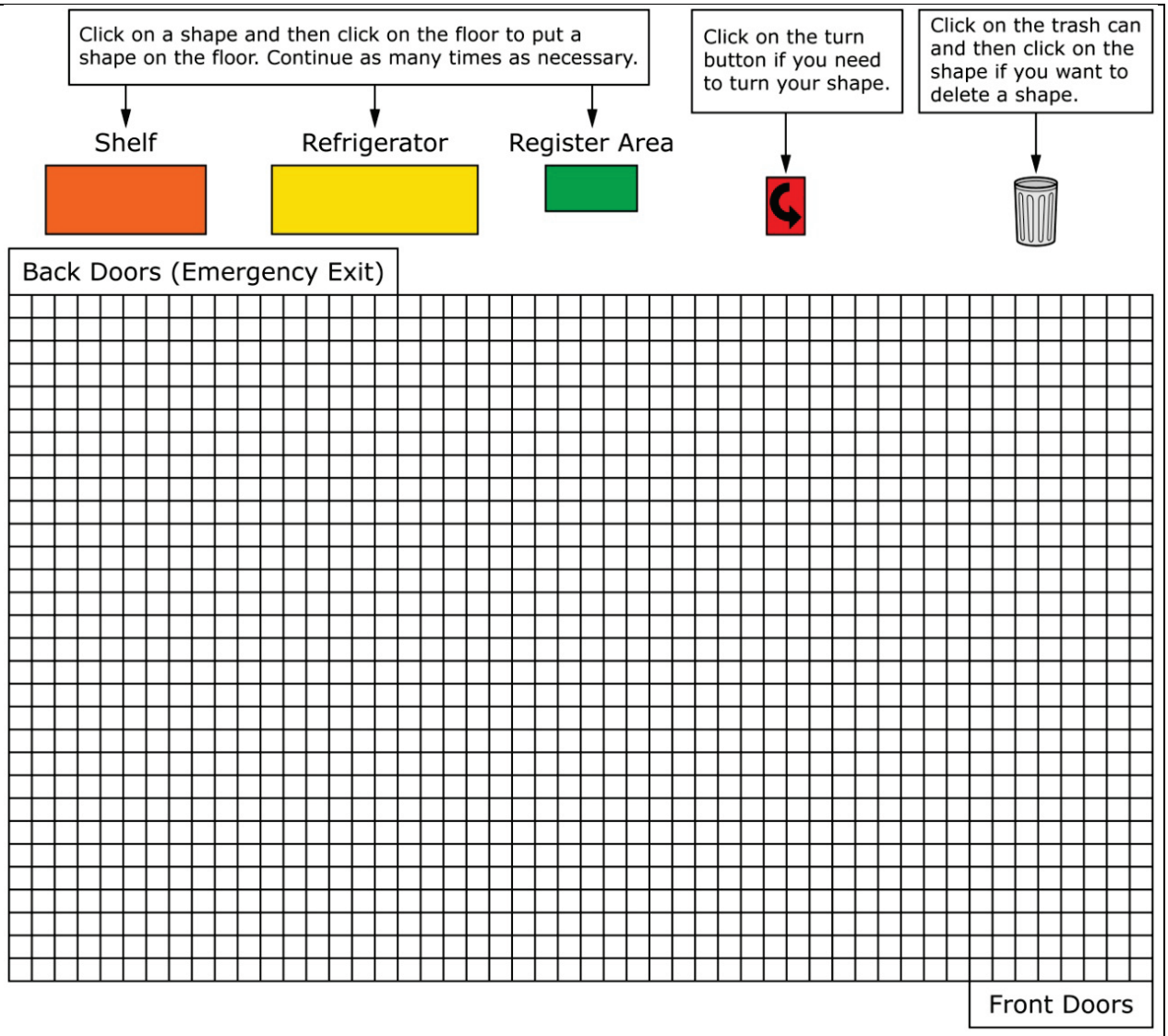
Each register area measures 2 yards by 4 yards.

 = Register Area

Use the guidelines that follow to create a floor layout plan.

Floor Layout Guidelines:

1. Use exactly 6 refrigerators.
2. Use exactly 18 shelves.
3. Use exactly 5 register areas.
4. Each shape must be placed at least 2 yards away from each other shape and from the doors so there is a path for customers between the shapes.
5. Each register area must be exactly 2 yards away from another register area.



Part B

Store Layout (Letter to Fire Inspector)

Before the store can open, you must use the store layout to prepare a report for the fire inspector. The fire inspector needs to make sure all the people in the store can get out quickly enough in case of an emergency. The fire inspector has given you the directions below to figure out the greatest number of people who can safely be in the store at one time.

Directions:

1. Find the area of the store floor not covered by shelves, refrigerators, or register areas. This is the area of the floor customers will use to walk around the store.
2. Divide this area by 2.

This gives you the greatest number of people who can safely be in the store at one time.

Write a report to the fire inspector telling him the greatest number of people who can safely be in your store at one time. Explain to him how you found the area of the store floor that customers will use to walk around the store.

[Expand the area for a student's response as appropriate.]

Part C

Item Pricing

The last task you need to complete before the store opens is the item pricing. The table below shows the cost to buy each different item from a manufacturer. The table also shows the amount of money the store will earn when the store sells the item. The equation below shows how to find the price that the store must charge customers in order to earn the correct amount of money.

Cost from Manufacturer + Amount Earned = Price to Charge Customers

Use the equation to complete the table.

Item	Cost from Manufacturer	Amount Earned	Price to Charge Customers ($)
Milk	$2	$1	
Eggs	$3	$1	
Trash bags	$5	$1	
Cereal	$3	$2	
Peanut butter	$2	$2	
Lunch meat	$2	$2	

If a customer buys one of each of these items, what is the total price, in dollars, he or she will be charged? What is the total amount the store will earn? Show how you found your answer.

If each of 50 customers buys 1 of each item in the table, what is the total amount of money the store will earn? Show how you found your answer.

Part D

[Teacher must distribute copies of the bar graph created during the prework for this task.]

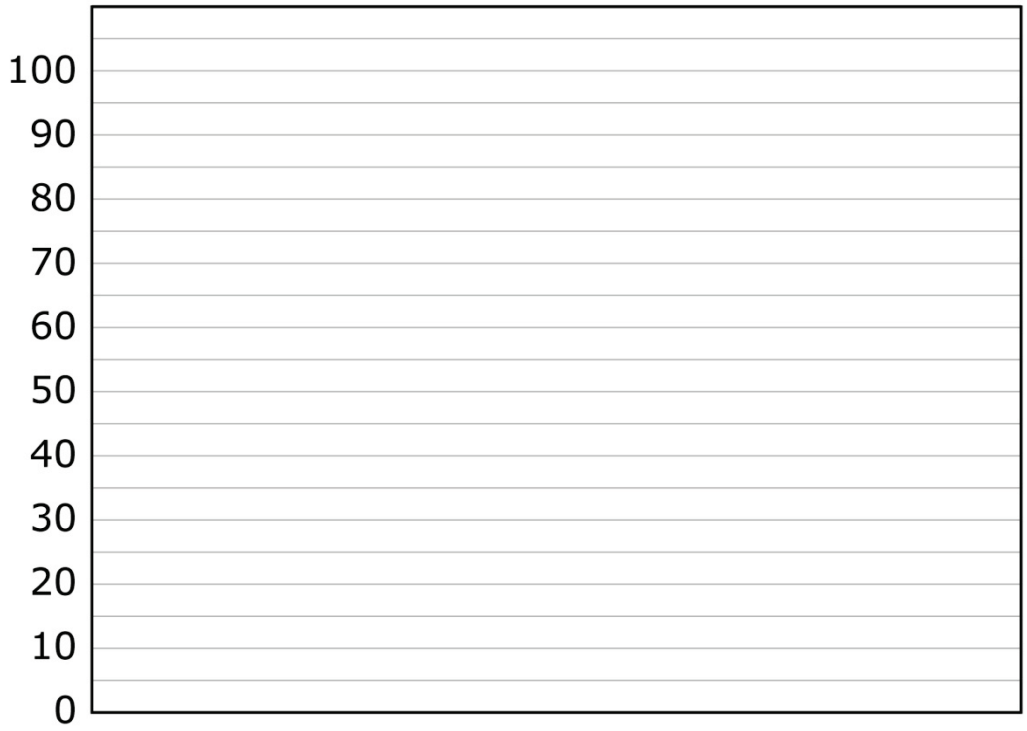
Plan for Workers

A manager of a different store surveyed 50 adult customers. She asked each customer to answer the question, "During which part of the day do you usually shop for groceries? In the morning, afternoon, or evening"? This is the same question we asked adults to get the data for our graph. The manager created the table shown below.

Manager's Survey Results

Part of the Day	Number of Customers Who Shop
Morning	5
Afternoon	15
Evening	30

Combine the data from the graph we completed in class with the data in this table to represent all 100 adults surveyed. Create a new bar graph below. Make sure to use an appropriate title and appropriate labels.



Write fractions to represent the adults out of the 100 adults surveyed who shop for groceries in the morning, the afternoon, and the evening.

$\frac{\square}{\square}$ Morning

$\frac{\square}{\square}$ Afternoon

$\frac{\square}{\square}$ Evening

Which part(s) of the day show fractions that are less than or equal to $\frac{1}{2}$? Show how you found your answer.

Look at the fractions you wrote for each part of the day. If a fraction is less than or equal to $\frac{1}{2}$, you will hire 16 workers for this part of the day. If a fraction is greater than $\frac{1}{2}$, you will hire 20 workers for this part of the day. Complete the table below with this information.

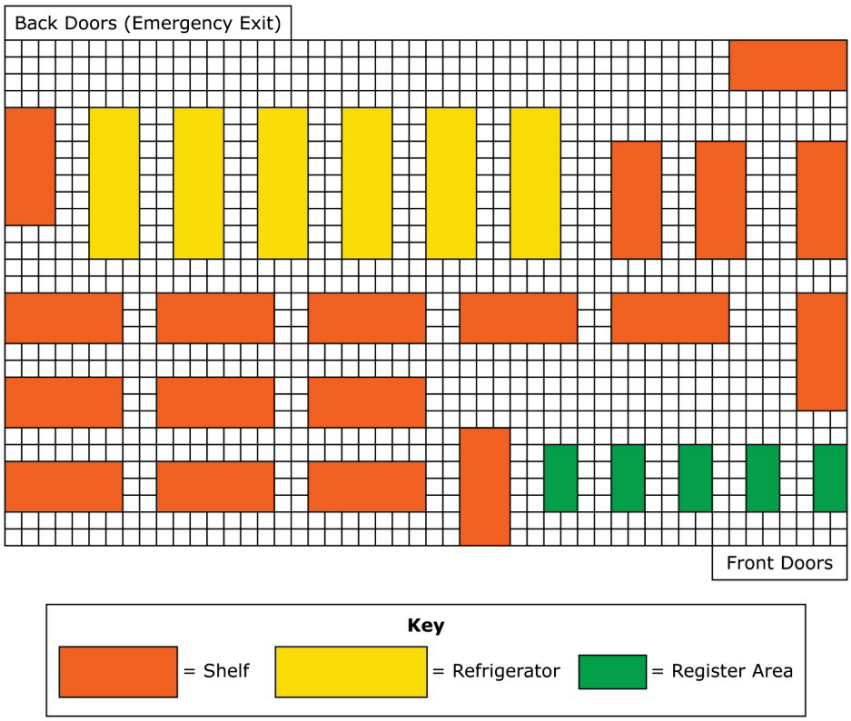
Workers to Hire

Part of the Day	Number of Workers to Hire
Morning	
Afternoon	
Evening	

Based on this table, what is the total number of workers you will hire for your grocery store? Show how you found your answer.

Sample Top-Score Response:

Part A. Floor Layout diagram follows all guidelines. (Not scored)



Part B. The letter to the fire inspector includes information about the total area of the store floor (1,500 square yards), the area covered by shelves, refrigerators, and register areas (580 square yards), the area customers will use for walking (920 square yards), and a maximum occupancy of 460 people. The letter also includes detailed explanations of how areas were calculated.

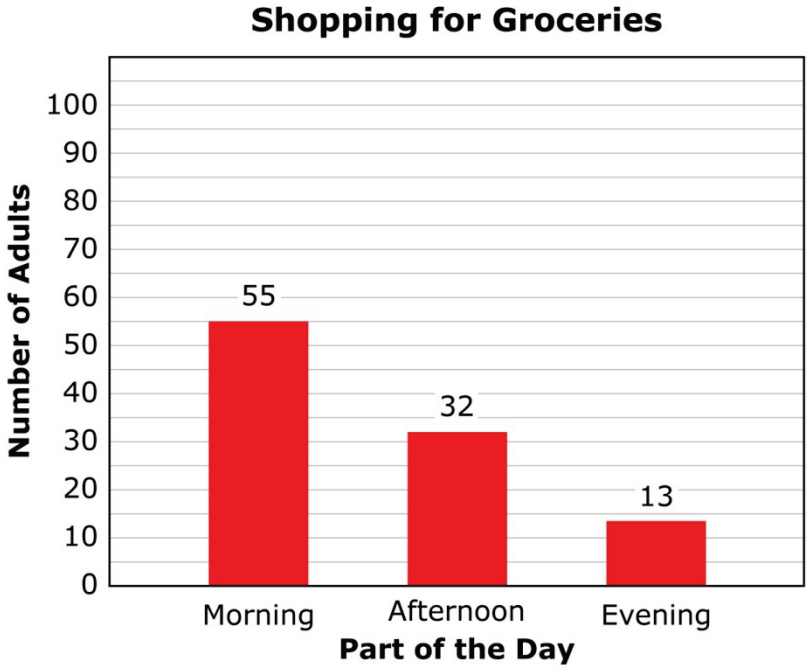
Part C. The student completes the table as shown.

Item	Cost from Manufacturer	Amount Earned	Price to Charge Customers ($)
Milk	$2	$1	$3
Eggs	$3	$1	$4
Trash bags	$5	$1	$6
Cereal	$3	$2	$5
Peanut butter	$2	$2	$4
Lunch meat	$2	$2	$4

The student writes $26 for the price the customer will be charged, $9 for the amount the store will earn, and provides a correct explanation of work.

The student writes $450 and provides a correct explanation of work.

Part D. The student combines data graph created in class with data from table to create new bar graph. The bar graph shows an appropriate title and appropriate labels and shows combined data from class-created graph and table.



The student writes fractions that reflect a number out of 100 total adults surveyed for each part of the day. Data used determines these fractions and will vary dependent on initial data from class-created graph. Fractions from sample top-score response above are:

$\frac{55}{100}, \frac{32}{100}$, and $\frac{13}{100}$ or equivalent fractions.

The student indicates all fractions that represent fewer than $\frac{1}{2}$ of the 100 adults surveyed. For sample top-score response above, the student indicates $\frac{32}{100}$ and $\frac{13}{100}$.

The student correctly completes table for number of workers to hire using information from above.

Workers to Hire

Part of the Day	Number of Workers to Hire
Morning	20
Afternoon	16
Evening	16

The student correctly indicates total number of workers to hire from data in the table (52).

Scoring Notes:

Each scored portion of the task is evaluated individually. The total number of points is determined by adding the points assigned for each task.

Scoring Rubric:

Part A: not scored

Part B:

5 points: Thorough understanding of area using addition and subtraction to compare areas. Thorough understanding of division of a 3-digit number by a 1-digit number. The student correctly calculated 1500 square yards, 580 square yards, 920 square yards, and 460 people. The student also provided explanations of correct work in the letter to the fire inspector.

4 points: Solid understanding of area using addition and subtraction to compare areas. Partial understanding of division of a 3-digit number by a 1-digit number. The student made a minor error in calculation that led to an incorrect answer, but provided explanations of work that showed conceptual understanding. **OR** The student correctly calculated 1500 square yards, 580 square yards, 920 square yards, and 460 people, but did not provide explanations of work in the letter to the fire inspector.

3 points: Good understanding of area using addition and subtraction to compare areas. Partial understanding of division of a 3-digit number by a 1-digit number. The student made 2 errors in calculation that led to other incorrect answers, but provided explanations of work that showed conceptual understanding in the letter to the fire inspector. **OR** The student correctly completed 3 of the following (calculated 1500 square yards, 580 square yards, 920 square yards, 460 people, and provided explanations of work in the letter to the fire inspector).

2 points: Partial understanding of area using addition and subtraction to compare areas. Partial understanding of division of a 3-digit number by a 1-digit number. The student made 3 errors in calculation that led to other incorrect answers, but provided explanations of work

that showed conceptual understanding in the letter to the fire inspector. **OR** The student correctly completed 2 of the following (calculated 1500 square yards, 580 square yards, 920 square yards, 460 people, and provided explanations of work in the letter to the fire inspector).

1 point: Limited understanding of area using addition and subtraction to compare areas. Limited understanding of division of a 3-digit number by a 1-digit number. The student made 4 or more errors in calculation, but provided explanations of work that showed some conceptual understanding in the letter to the fire inspector. **OR** The student correctly completed 1 of the following (calculated 1500 square yards, 580 square yards, 920 square yards, and 460 people, provided explanations of work in the letter to the fire inspector).

0 points: No understanding of area using addition and subtraction to compare areas. No understanding of division of a 3-digit number by a 1-digit number. The student incorrectly calculated in all parts, and did not provide explanations of work in the letter to the fire inspector.

Part C:

4 points: Thorough understanding of using equations to model addition, addition of whole numbers, and multiplication with whole numbers. The student correctly completes all parts of the task and provides correct explanations of work where required.

3 points: Good understanding of using equations to model addition, addition of whole numbers, and multiplication with whole numbers. The student correctly completes 2 parts of the task and provides correct explanations of work for these tasks if required. **OR** The student completes all parts of the task, but does not provide thorough explanations of work where required. **OR** The student makes a mistake when completing the table, and correctly completes all other parts of the task using incorrect table data.

2 points: Partial understanding of using equations to model addition, addition of whole numbers, and multiplication with whole numbers. The student correctly completes 1 part of the task and provides correct explanations of work for these tasks if required. **OR** The student completes 2 parts of the task, but does not provide thorough explanations of work for some parts where required. **OR** The student makes a mistake when completing the table, and correctly completes 1 of the other parts of the task using incorrect table data.

1 point: Limited understanding of using equations to model addition, addition of whole numbers, and multiplication with whole numbers. Limited understanding of calculating and interpreting remainders in a contextual situation. The student correctly completes 1 part of the task with no correct explanation of work.

0 point: No understanding of using equations to model addition, addition of whole numbers, multiplication with whole numbers, and division of whole numbers. No understanding of calculating and interpreting remainders in a contextual situation. The student does not correctly complete any parts of the task.

Part D:

6 points: Thorough understanding of representing and interpreting data, fraction equivalence and ordering, and using operations with whole numbers to solve problems. The student correctly answered each section in *Part D* and provided clear and thorough explanations of work where required. Point distribution as shown below:

1 point: Completed graph with correct data
1 point: Completed graph with correct title and labels
1 point: 3 correct fractions reflecting data from each part of the day
1 point: All fractions less than ½ represented; explanation of work is included
1 point: Table is correctly completed with numbers of workers to be hired
1 point: Total number of workers is determined correctly; explanation of work is included

5 points: Solid understanding of representing and interpreting data, fraction equivalence and ordering, and using operations with whole numbers to solve problems. The student correctly answered each section in *Part D* but provided one or two incomplete or incorrect explanations of work. **OR** The student correctly answered 5 out of 6 sections from *Part D,* and provided clear and thorough explanations of work where required. **OR** The student made an error in an early section and carried that error out throughout the remaining sections of *Part D*, and provided clear and thorough explanations that showed evidence of understanding the concepts presented.

4 points: Good understanding of representing and interpreting data, fraction equivalence and ordering, and using operations with whole numbers to solve problems. The student correctly answered 4 out of 6 sections from *Part D,* and provided clear and thorough explanations of work where required. **OR** The student correctly answered 5 out of 6 sections from *Part D,* but provided one or two incomplete or incorrect explanations of work.*

3 points: Partial understanding of representing and interpreting data, fraction equivalence and ordering, and using operations with whole numbers to solve problems. The student correctly answered 3 out of 6 sections from *Part D,* and provided clear and thorough explanations of work where required. **OR** The student correctly answered 4 out of 6 sections from *Part D,* but provided one or two incomplete or incorrect explanations of work.*

2 points: Limited understanding of representing and interpreting data, fraction equivalence and ordering, and using operations with whole numbers to solve problems. The student correctly answered 2 out of 6 sections from *Part D,* and provided clear and thorough explanations of work where required. **OR** The student correctly answered 3 out of 6 sections from *Part D,* but provided one or two incomplete or incorrect explanations of work.*

1 point: Inconsistent understanding of representing and interpreting data, fraction equivalence and ordering, and using operations with whole numbers to solve problems. The student correctly answered 1 out of 6 sections from *Part D,* and provided clear and thorough explanations of work if required in this section. **OR** The student correctly answered 2 out of 6 sections from *Part D,* but provided one or two incomplete or incorrect explanations of work.*

0 points: No understanding of representing and interpreting data, fraction equivalence and ordering, and using operations with whole numbers to solve problems. The student incorrectly answers each section or does not attempt each section in *Part D.*

*If a minor error was made in an early section and carried out throughout the remaining sections of *Part D*, the error should only be counted one time. The scoring of the subsequent sections should only negatively impact the student if additional errors are made.