Electrical (46.0399) T-Chart

Pennsylvania DEPARTMENT OF EDUCATION

Estimate costs associated with construction projects	=	Summarize, represent and interpret data on two categorical and quantitative variables

Program Task: Estimate costs associated with construction projects; utilize graphs for reference.

PA Core Standard: CC.2.4.HS.B.2

Description: Summarize, represent and interpret data on two categorical and quantitative variables.

Program Associated Vocabulary:
ESTIMATING, PLOTTING, AVERAGES

Math Associated Vocabulary:
CIRCLE, LINE GRAPH, BAR GRAPH

Program Formulas and Procedures:
The hourly rate of apprentices is based on the rate of journeymen. Usually, this information is presented in a table, with 1st, 2nd, 3rd, 4th, and 5th year apprentices making 40%, 50%, 60%, 70%, and 85% respectively of the journeyman rate. Regardless of how the information is presented, the information itself provides critical information to consider during negotiations.

Hourly rate of 1st and 3rd Year Apprentices (based on the Journeyman Rate)
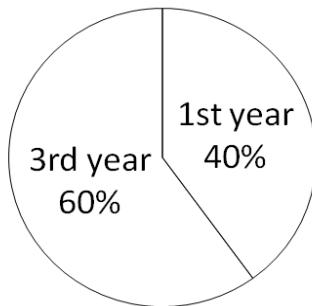
There are many questions one could ask from the information presented in the graph. Here are two:

Example 1:
If the journeyman rate is $38.50 an hour, what is the apprentice rate for a 1st year apprentice?

Answer:
Apprentice = Percent x Journeyman rate

40% x $38.50 = 0.40 x 38.50 = $15.40 / hr.

Example 2:
If the first year apprentice rate increases to $16.50/hr., what must the journeyman rate be?

Answer:
Apprentice = Percent x Journeyman rate

$16.50 = 0.40j$

$$\frac{16.50}{0.40} = \frac{0.40j}{0.40}$$

$41.25 / hr = j$

Journeyman rate would increase to $41.25

Formulas and Procedures:
Predictions can be made from information presented in graphs by estimating or calculating. Common types of graphs include circle (pie) graphs, line graphs, and bar graphs. The process for making predictions depends upon the type of graph. A circle graph requires an understanding of percentages. Bar graphs are used to compare amounts. Line graphs are used to show trends.

Making Predictions: Circle Graphs
If 170 students selected the piano as their favorite musical instrument, approximately how many students were surveyed?

1. Read and comprehend the graph.
   30%, or 170 of the total students surveyed chose the piano
2. Translate the problem into an algebraic expression.
   30% of the students is 170. →
 $0.30(s) = 170$
3. Solve for the unknown variable.
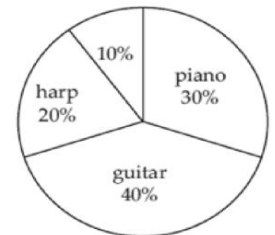
$$0.30s = 170 \rightarrow \frac{0.30s}{0.30} = \frac{170}{0.30} \rightarrow s = 566.\overline{66}$$

Approximately 567 students were surveyed.

Bar Graphs:
By what percentage did water sales increase between the first and eighth months?

1. Read and comprehend the graph.
   The graph shows the number of gallons of water sold each month over an 8 month period.
2. Determine the amount of change.
   Month 1 = 200 gallons, Month 8 ≈ 375 gallons
   375-200 = 175
3. Calculate percentage of increase.
   175/200 = .875 or 87.5%
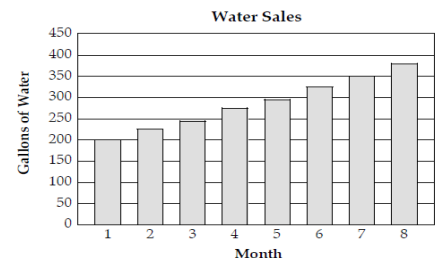
Instructor's Script – Comparing and Contrasting
In the example on the Electrical Occupations side of the T-Chart, a circle graph is used to show how first and third year apprentice salaries are determined by journeymen rates. Although this information is usually depicted in a chart, this example provides a great opportunity for students to use circle graphs to make predictions.   When creating problems involving a circle graph remember that the circle graph represents parts of a whole

If the bid for the job includes salaries, materials, and miscellaneous expenses, these parts (categories) can be displayed in a circle graph.

To integrate line and bar graphs, create a line or bar graph from values found in a table. Ask students to predict values that are **not** displayed on the graph.

Common Mistakes Made By Students
Incorrectly converting percents to decimals:
Many of the mistakes students make when converting percentages to decimals involve one or 3 digit numbers. For instance, students mistakenly write 6% as 0.6 instead of 0.06 or they write 125% as 0.125 instead of 1.25.

Incorrect computation with percentages: Write an algebraic expression from the information provided. Use key words to determine the appropriate operation. For instance, "of" means "x"; "is" means "=." Students who do not write algebraic expressions have a tendency to divide when they should multiply and vice versa.

CTE Instructor's Extended Discussion
Before construction projects are awarded to the most qualified bidder, project estimators first must figure out the approximate cost of the project. These estimates are derived by estimating the number of workers that will be needed, along with the hourly rate each worker will earn.

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Problems	Career and Technical Math Concepts	Solutions

1. What will be the approximate cost of the job if there were 450 hours worked?

2. What will be the approximate cost of the job, if the rate was reduced by 25%, and there was 500 hours worked?

3. What will be the estimated cost if there were 200 hours worked on a Saturday? (Reminder: Saturdays are worked at 1.5 times the hourly rate.)

Job cost per hours worked

Problems	Related, Generic Math Concepts	Solutions

4. If there are 2,825 teenagers enrolled in your school, about how many would you expect to be employed in retail?

5. If approximately 25,000 teenagers work in the service industry, about how many working teenagers are there?

6. If there are 2,825 teenagers enrolled in your school, about how many teenagers work in manufacturing or agriculture?

Where Teens Work

Problems	PA Core Math Look	Solutions

7. The total amount of expenditures of the company is how many times that spent on taxes?

8. If $250,000 is spent on advertising, then what is the difference in expenditure between taxes and transport?

9. If the loan interest is $275,000, then what is the total amount of expenditure on advertisement, taxes, and research and development?

Problems	Career and Technical Math Concepts	Solutions
1. What will be the approximate cost of the job if there were 450 hours worked?		By reading the graph, a good estimate for 450 hours would be $35,000.
2. What will be the approximate cost of the job, if the rate was reduced by 25%, and there was 500 hours worked?		By reading the graph, a good estimate for 500 hours is $37,000 $37,000 x 25% = 37000 x 0.25 = $9250 $37000 – $9250 = $27,750
3. What will be the estimated cost if there were 200 hours worked on a Saturday? (Reminder: Saturdays are worked at 1.5 times the hourly rate.)		By reading the graph a good estimate for 200 hours is $15,000 Saturdays are overtime so… $15000 x 1.5 = $22,500

Problems	Related, Generic Math Concepts	Solutions
4. If there are 2,825 teenagers enrolled in your school, about how many would you expect to be employed in retail?		54% of 2,825 is the number employed in retail. $0.54(2,825) = x \rightarrow 1,525.5$ or 1,526 students.
5. If approximately 25,000 teenagers work in the service industry, about how many working teenagers are there?		25,000 is 25% of the number of working teenagers $25,000 = 0.25x \rightarrow \dfrac{25,000}{0.25} = \dfrac{0.25x}{0.25}$ $x = 100,000$ working teens.
6. If there are 2,825 teenagers enrolled in your school, about how many teenagers work in manufacturing or agriculture?		Manufacturing = 5%, agriculture = 5% 10% of 2,825 is the number of teens who work in manufacturing or agriculture $0.10(2,825) = 282.5$ or about 283 students.

Problems	PA Core Math Look	Solutions
7. The total amount of expenditures of the company is how many times that spent on taxes?		Taxes =20%. $5 \times 20\% = 100\%$ (total expenditures) Total expenditures are 5 times the amount of taxes.
8. If $250,000 is spent on advertising, then what is the difference in expenditure between taxes and transport?		Advertising = 10% = $250,000 Taxes (20%) – Transport (15%) = 5% , which would be half of $250,000 $125,000 is the difference between taxes and transport.
9. If the loan interest is $275,000, then what is the total amount of expenditure on advertisement, taxes, and research and development?		Loan interest = 5% = $275,000. Advertising = 10%, taxes = 20%, and R & D = 5% $550,000 + $1,100,000 + $275,000 = $1, 925,000 $1,9250,000