Creating Customer Quotes

Creating Customer Quotes

Industry Sector: Advanced Manufacturing
Content Area: Mathematics
Core Topic: Order of Operations and Percentages

Common Core State Standards

Content Standards

- **CCSS.Math.Content.5.OA.A.1** Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
- **CCSS.Math.Content.5.OA.A.2** Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation "add 8 and 7, then multiply by 2" as 2 (8 + 7). Recognize that 3 (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.
- **CCSS.Math.Content.5.MD.C.5** Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
- **CCSS.Math.Content.6.RP.A.3c** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
- **CCSS.Math.Content.6.RP.3d** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Practice Standards

- **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.**
  Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

This workforce solution is 100% funded by a grant awarded by the U.S. Department of Labor, Employment and Training Administration, TAACCCT grant agreement # TC-22505-11-60-A-25.The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. Massachusetts Community Colleges are equal opportunity employers. Adaptive equipment available upon request for persons with disabilities.

Adult Basic Education Standards

Content Standards

- **4.NBT.4** Use place value understanding and properties of operations to perform multi-digit arithmetic. Fluently add and subtract multi-digit whole numbers using the standard algorithm.
- **4.NBT.5** Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
- **6.RP.3c** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

Practice Standards

- **CCSS.Math.Practice.MP2 Reason abstractly and quantitatively**
  Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

Industry Overview

Today's Manufacturing Workplace

A manufacturing renaissance is occurring in the United States. The United States is the largest manufacturing economy in the world, producing 21 percent of the goods manufactured across the globe. In addition to the 12 million Americans working directly in the manufacturing industry, manufacturing supports more than 6.5 million other jobs, thus accounting for nearly 17 percent of all private sector jobs in the United States. In 2010, the average U.S. manufacturing worker earned $77,186, including pay and benefits (the average in all industries was $56,436).[1]

While manufacturing jobs in Massachusetts have declined, as they have nationally, manufacturing is still a critical industry in this state and provides opportunities for good, high-paying jobs. In the Greater Boston area, most of the manufacturing jobs are in computer and electronics companies, and much of the state relies on manufacturing positions in these and other very high-tech areas, such as aerospace and biotechnology.[2]

Advanced manufacturing involves the use of computers and technology in the manufacture of products. While not all manufacturing companies use technological innovations in developing their products or processes, the competitive advantage of the United States in the manufacture of goods relies on technological innovations. This means that today's manufacturing workplace is

usually highly technical, which accounts for the high-paying positions many workers in this field receive in compensation for their work. It also means that today's advanced manufacturing workplace is very different from many people's conceptions of factories and mills as dark, dirty, and unsafe. Today's advanced manufacturing facilities are usually bright, clean, and very safe, and the emphasis is on working efficiently with as little waste as possible.

In the advanced manufacturing industry, there has been a marked shift from the traditional role of line workers to workers who demonstrate creativity and innovation. Innovation is a hallmark of the U.S. manufacturing industry, and key to maintaining its position in the global market since products can often be produced at a lower cost in developing countries. Critical-thinking, problem solving and reasoning are important components of the innovation process. Today's manufacturing workers are expected to formulate solutions to problems using critical thinking and reasoning skills while working independently and/or in teams.

1. http://www.nam.org/~/media/AF4039988F9241C09218152A709CD06D.ashx
2. http://www.bostonglobe.com/business/2012/05/08/high-end-factory-jobs-boston-paying-high-wages/3gZuNc6GywDGKoYNP2hnaO/story.html?camp=pm

Careers in Advanced Manufacturing

The manufacturing sector includes jobs related to planning, managing, and performing the processing of materials into intermediate or final products and related activities such as production planning and control, maintenance, and engineering. Thus, this industry includes not only those people who actually produce the manufactured goods, but also managers, maintenance staff, scientists and researchers, analysts, administrative personnel, and IT personnel.

Career Pathways

The manufacturing industry includes six career pathways:

- Production is the construction and assembly of parts and final products. People in these positions work in factories and mills, with machines, to make or assemble parts, construct components of parts (such as plastics), and print materials. Occupations in this pathway range from production helpers who move parts and materials around the factory, to numerical control machine operators who run the computer-controlled machines that modify metal and plastic to create products, to manufacturing production technicians who oversee production.
- Manufacturing production process development occupations are involved in designing products and manufacturing processes. People in these occupations work with production workers to set up the machines and processes to develop new products. These occupations include engineers and production managers.
- Maintenance, installation and repair workers take care of products after they've been sold and delivered to customers, they install the products, perform maintenance on machines, tools, and equipment so that they work properly, and repair systems that are not performing adequately. Workers in this pathway include automotive technicians, automotive electronics installers, building maintenance workers, industrial electronics repairers, industrial machinery mechanics, millwrights, and small engine mechanics.
- Quality assurance is provided by quality control inspectors and technicians, who ensure that products both meet design standards and are of high quality.

- Logistics and inventory control workers ensure that those working in Production have the materials they need to complete their work. Workers in these occupations inventory materials and products, move materials to the line, and pack and ship finished products. Thus, they include production and planning clerks, and operators of moving machinery such as cranes and forklifts, and packers.
- Health, safety and environmental assurance occupations are focused on keeping the workplace safe by ensuring that workers are using equipment safely and that manufacturing processes are as safe as they can be. The also conduct investigations and conduct inspections.

Mathematics and Communication Skills Needed in Advanced Manufacturing

Mathematics and communication are key skills needed for success in today's high-performance advanced manufacturing workplaces. Mathematics is used in the advanced manufacturing industry to measure the amounts and sizes of materials and parts, create "recipes" used to manufacture man-made materials, and analyze data. Data analysis is critical at many levels of a manufacturing organization in order to ensure quality and to continuously improve both quality and processes. Today's manufacturing industry must operate extremely efficiently and produce very high-quality products in order to maintain competitiveness. Many front-line workers are involved in collecting data and working to improve quality and efficiency. Thus, in addition to basic mathematical calculations (which rarely involve simple whole numbers), workers are engaged in mathematical reasoning and solving problems using a variety of mathematical tools.

To succeed and move up the ladder in today's advanced manufacturing workplace, workers need reading skills to understand technical concepts, vocabulary, and to bring together information needed for a particular situation; to locate, organize, and document written information from various sources needed by co-workers and customers; and to locate written information needed by co-workers and customers. They need to use correct grammar, punctuation and terminology to write and edit documents and to develop and deliver formal and informal presentations using appropriate media to engage and inform audiences. In addition, they need to interpret verbal and nonverbal behaviors to enhance communication with co-workers and clients/participants; apply active listening skills to obtain and clarify information; and interpret and use information in tables, charts, and figures to support written and oral communications. They also must communicate with co-workers and customers using technology tools. As they move up the corporate ladder they will need to explain written organizational policies, rules and procedures to help employees perform their jobs.

Career Opportunities in Advanced Manufacturing with Education from Community Colleges

Massachusetts Community Colleges play an important role in preparing the state's citizens to take advantage of the career opportunities available in advanced manufacturing. Degree and certificate programs prepare students to enter advanced manufacturing occupations, including:

- production occupations, including people who work as assemblers (such as airplane assemblers), machine operators, machinists, systems operators, CNC machine tool operators, machine setters, laminators/fabricators, metal and plastic workers, packers, molders, semiconductor processing operators, welders and solderers, tool and die makers, and other production workers;

- manufacturing production process development occupations, including numerical control tool programmers who write the programs that control machine tools and industrial production managers who plan and oversee production;
- maintenance, installation and repair occupations include automotive, electronics, and biotechnology technicians, industrial machinery mechanics, and millwrights (who install and maintain heavy equipment);
- quality assurance occupations including quality control technicians and inspectors.

Recent Career Opportunities in Massachusetts

The following is a sample of advanced manufacturing job listings in Massachusetts that require associate's degree or certificate:

- Manufacturing Engineering Technician, Randstad Corporation, Framingham, MA,
- Quality Control Technician, QD Vision, Lexington, MA
- Manufacturing Technican, Hologic, Marlborough, MA

Employment Outlook for Advanced Manufacturing

Advanced manufacturing continues to be a high-growth industry, given the knowledge capital in the United States. However, the work in this industry is increasingly technical and requires far fewer workers as more tasks are automated. Entry-level positions in this industry require the same skills that only a select group of highly-experienced and well-paid workers once had. Unfortunately manufacturers find it difficult to fill these high-skill positions. A 2011 survey found that there is a persistent skills gap between the skills that are needed in the today's manufacturing workplace and the skills that candidates bring to the workforce.

Most of the advanced manufacturing companies in Massachusetts are small to mid-sized operations that employ smaller numbers of workers and rely on computer-operated machinery for production. While the numbers of workers are smaller than in the past, the more highly-skilled nature of the work means that these are high-paying jobs and provide workers with opportunities to grow through training and education and to be part of the effort to innovate.

Resources:

Advanced Manufacturing Industry

- National Council for Advanced Manufacturing
- Advanced Manufacturing
- Brookings: "Why Does Manufacturing Matter? Which Manufacturing Matters?" (2012)
- National Association of Manufacturers: "A Manufacturing Renaissance: Four Goals for Economic Growth" (2012)

Advanced Manufacturing Industry Outlook Information

- Bureau of Labor Statistics: Manufacturing Industry at a Glance
- Massachusetts Labor Market Data
- Massachusetts Career Information System

Careers in Advanced Manufacturing

- Massachusetts Career Information System
- Manufacturing Career Opportunities
- Manufacturing Career Pathways
- Industry Competency Model for Advanced Manufacturing shows the skills and knowledge needed to work in this industry
- National Association of State Directors of Career Technical Education Consortium?s Common Career Technical Core
- National Association of State Directors of Career Technical Education Consortium?s Knowledge and Skills: Manufacturing
- O*NET
- WorkKeys Occupational Profiles
- Manufacturing?s Missing Generation
- A Career in Toolmaking or Machining Technologies: The Right Choice for Students, Community, & Country

Workplace Scenario (8th Grade Level)

Your job role is a Program Manager. You work for a mid-size plastics manufacturing company. Your company specializes in changing metals to plastic. This means that it makes parts from plastic that used to be manufactured from metal. Plastic parts weigh less and are stronger. They can be manufactured more quickly and cheaply.

One of your main jobs is to prepare price quotes for clients. A client usually has a specific product in mind. The client contacts your team to discuss the details. You then prepare a price quote. The quote lists the materials, costs for assembly and decoration, and any packaging fees. You also calculate the margin your company includes (sometimes called mark-up). This is a percentage of the order cost. It is added to the final price for the customer.

If you are preparing a price quote for a repeat customer, you may start with a prior order. However, you will need to update the calculations. There may be price changes in materials and/or labor. Or there may be other changes in how the work will be completed. If the price has gone up, you identify the increased pricing for the customer. You document the increases so that the customer understands the new cost.

Your calculations will involve operations with decimals in multiple steps. You also work with whole numbers and calculating percentages. The percentages may apply to individual components or the whole job.

Workplace Scenario (High School Level)

You are a Program Manager for a mid-size plastics manufacturing company in Western Massachusetts. Your company specializes in metals to plastic conversion. This means that it makes parts from plastic that previously were manufactured from metal. Converting from metal to plastic has many benefits. These include lighter-weight components, cost savings, improved efficiency, and structural strength improvement.

A key responsibility as Program Manager is to prepare price quotes for clients. A client typically has a specific product in mind and contacts your team to discuss the details. You then prepare a

price quote. The quote details the materials required for assembly, labor costs for assembly and decoration, and any packaging fees. You will also need to calculate the margin your company includes (sometimes called mark-up). This is a percentage of the order cost that is added on to the price when calculating the final price for the customer.

In preparing the price quote, you may start with a prior order if you are working with a repeat customer. However, you will need to update the calculations based on price changes in materials and/or labor or other changes in how the work will be completed. If the price has gone up, you will need to identify the increased pricing for the customer. You document those increases so that the customer understands the costs they are being charged to produce their product.

Your calculations will involve completing multi-step arithmetic calculations and operations with decimals. You also work with whole numbers and calculating percentages on individual components and/or the whole job.

Core instructional context

Professions that work with money require fluency computing with multi-digit numbers, decimals, and percentages, as well as strong mathematical reasoning skills to work with customers, make business decisions, and solve problems. These important math procedure and application skills are used daily in the workplace and at home.

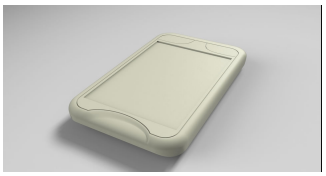
In advanced manufacturing jobs such as the program manager position described in this module, accurately determining what it costs to produce something is vital to the success of the business. This calculation involves applying the order of operations, multiplication, addition, division, and working with different types of units to make real world decisions.

A deep understanding of math is required; just plugging numbers into formulas instead of understanding what is being calculated and why can lead to mistakes. For example, a Program Manager may manipulate numbers to bring down the price of a product to win a contract, negotiate and apply discounts for bulk purchasing of raw materials, recognize the need to convert units for accurate computations, and identify the need to increase or decrease overhead costs to remain competitive in the industry. Additionally, it is important to work with accuracy and precision. If the Program Manager in this scenario accidentally calculates the wrong price for the raw materials, the company could lose money.

The real world math examples in this module illustrate fluency with computations and abstract reasoning in the workplace.

Worked Examples

Prepare a Quote for a Potential Client: Cellphone Case



A potential client asks for a quote from your company to manufacture 5000 units of a plastic cellphone cover. The client's industrial engineer emailsyou the CAD drawings (click image and select "Open in 3D Viewer" to explore the 3D renderings) and the mass properties of the product. The mass properties provideyou information about the weight, volume, and surface area of the product and you need this information to calculate the price of the materials.

To prepare the quote, you make a series of calculations?materials, labor, and margin, and plug them into your company's quoting software.

1. Part Weight. To price the materials in the quote, you need to know how much plastic will be in the product. You calculate this by multiplying the volume of the product (the amount of space the object occupies) by the specific gravity (this a measurement of density used by the plastics industry). Plastic pellets are purchased by the pound, so this formula provides the part weight for the product.

   The cellphone cover will be made of polycarbonate because that is a hard, durable plastic that can handle being dropped. You consult the datasheet for polycarbonate and see that the specific density is 1.2 g/cm3 (grams per cubic centimeter). You then consult the mass properties information provided by the engineer and find that the volume of the cellphone cover is 2.3 cubic inches. The specific gravity is in cubic centimeters and the volume is in cubic inches, so you must first convert to metric.

   Step 1: First, convert to cubic measurements
   1 inch = 2.54 centimeters
   (1 inch)3 = (2.54 cm)3
   1 in3 = 16.387 cm3

   Step 2: Next, convert volume to cubic centimeters
   volume in cm3 = (volume in in3) x (16.387 cm3/1 in3)
   volume in cm3 = (2.3 x 16.387) cm3
   volume in cm3 = 37.69 cm3

   Step 3: Multiple volume by specific density
   37.69 cm3 (volume) x 1.2 g/cm3 (specific density) = 45.228

Answer: 45.23 grams

2. Cost of Materials. Your company is currently paying $3/lb for polycarbonate pellets. How much will the raw materials cost to produce the 5000 units of the product?

   Step 1: Find total weight for product
   5000 (# of units) x 45.23 grams (part weight) = 226,150 grams

   Step 2: Convert weight to pounds
   1 g = .0022 lbs
   226,150 (total part weight) x .0022 = 497.53 pounds

   Step 3: Find total price
   497.5 x 3 = $1492.50

Answer: $1492.50 for materials

3. Labor. A production run of this size will take a team of five people a full 8-hour day to program and set-up the machine, test and inspect the first units, monitor the production run, and package the product for shipping. You bill clients $95/hr for your machine operators. How much is the labor for the quote?

Step 1: Find total hours of labor
5 people x 8 hours = 40 hours

Step 2: Find total price
40 hours x 95 = $3800

Answer: $3800 for labor

4. Margin. Your company has a 30% margin that you add to all orders. This margin, also called overhead or a mark-up, covers the costs of running the business such as the purchase and maintenance of the machines, rent, utilities, salaries of the administrative and management employees, and company profit. What is the margin you'll use for this quote?

   Step 1. Calculate price of materials and labor.
   $1492.50 (materials) + $3800 (labor) = $5292.50

   Step 2: Find 30% of $5295.50
   .30 x 5295.50 =

Answer: $1587.75

5. What is the total amount for the quote?

   Step 1: Add the material, labor, and margin.
   1492.50 + 3800 + 1587.75 = 5292.50

Answer: $6880.25

6. In your quote, you provide the total amount as well as the price per unit. What is the price per unit? Why do you think it is good to provide the price per unit as well as the total price in the quote?

   Step 1: Divide total price by number of units.
   6880.25 5000 = 1.376

Answer: $1.38 per unit. Answers will vary, but this discussion gives students an opportunity to develop CCSS-M Practice 2, Reason abstractly and quantitatively.

Contextualized learning activities

Read the Scenario

Ask students to read the scenario in this module. Have students look for unfamiliar words or concepts and write them on the board. This scenario is about the business side of plastics manufacturing, so it will be helpful to show two videos to "set the stage" to engage students:

Plastic Injection Mold Making (1:33):
http://www.youtube.com/watch?v=WDc5ZWcHwiI
This short video shows the plastic machinery used in this module and discusses how a

manufacturer will begin with the CAD drawing, create a mold, and then create the product. This is similar to the company described in the scenario.

Cost Management Software (4:06)
http://www.youtube.com/watch?v=-WsQDXgPqcw
Advanced manufacturing companies use software to calculate manufacturing costs and to create job quotes. This video provides a short demo of one software product used by plastic manufacturing companies. Use this video to introduce students to the complexities around determining what it costs to manufacture a product. While software helps automate the quotations, the Program Manager must understand the underlying math to accurately use the quoting software. Ask students to write down any math they hear in the video.

After watching the videos, ask students to reread the scenario and share their ideas for how math is used in this career.

Worked Examples

Work through the multi-part worked example problem in the "Core instructional context" section as a full class or in small groups. Students should feel free to use their calculators throughout this module.

Contextualized Problems (3)

These problems can be done individually or in small groups.

Problem 1: You have worked with the 2LEE company for several years, manufacturing the plastic parts for their bike and ski racks for cars. They are low on their inventory of replacement bicycle wheel straps and call you to order 10,000 units. You look up their last order from a year ago for this part and see that it was priced as follows:

Units: 10,000
Material: $6145
Labor: $5035
Margin (30%): 3354.00
Total: $14,534
Price per unit: $1.45

Despite increases in oil prices, your company has been able to maintain a 30% margin. However, the raw materials for the plastic have gone up in price by 4.5% and you know that you are charging clients $100/hr for labor as opposed to the $95/hr you charged last year. How do you rework the quote for the 2LEE company? (Round to nearest 50 cents)

2LEE Quote: Bike Wheel Replacement Straps

Units:	10,000
Material:	
Labor:	

Margin:	
Total:	
Price per unit:	

Answer:

2LEE Quote: Bike Wheel Replacement Straps

Units:	10,000
Material:	6145 + (6145 x .045) = $6421.53 round to $6421.50
Labor:	5035 95 x 100 = $5035
Margin:	(6421.50 + 5035) x .30 = $3436.95 round to $3437
Total:	6421.50 + 5035 + 3437 = $14,893.50
Price per unit:	14,893.50 10,000 = 1.489 round to $1.49

Problem 2: Your company has a payment schedule that appears on the bottom of all quotes: 30% due upon receipt of Purchase Order, 45% due upon Completion, and 25% due within 30 days of freight delivery. Using this payment schedule, what are the three payments the 2LEE company will make for their order?

2LEE Payment Schedule

Timeline	**Payment**
Purchase Order (30%)	
Completion (45%)	
Delivery, net 30 days (25%)	
Total	

Answer:
2LEE Payment Schedule

Timeline	**Payment**
Purchase Order (30%)	14,893.50 x .30 = $4468.05
Completion (45%)	14,893.50 x .45 = $6702.07

Delivery, net 30 days (25%)	14,893.50 x .25 = $3723.38
Total	$14,893.50

Problem 3: After receiving your quote, the 2LEE company calls you and asks you to help them bring down the unit price. You suggest that they can save money on the manufacturing labor by a purchasing a larger quantity. The set-up time for the machines in the same, regardless of the size of the production run. You look up the break down for labor and see that it takes 9 hours for your team to set-up the machine and 44 hours to complete the production run of the 10,000 units. What is your labor quote for a run of 15,000 units? 20,000 units? 25,000?

Labor Quote

# of Units	Hours for Setup	Hours for Production Run	Total Hours	Total Labor at $100/hr	Labor per unit
10,000	9	44	53	$5300	
15,000					
20,000					
25,000					

Labor Quote: Answer

# of Units	Hours for Setup	Hours for Production Run	Total Hours	Total Labor at $100/hr	Labor per unit
10,000	9	44	53	$5300	$0.53
15,000	9	66	75	$7500	$0.50
20,000	9	88	97	$9700	$0.49
25,000	9	110	119	$11900	$0.48

Contextualized test items

1. The CEO of your company takes pride in providing a generous benefits package and has decided to add a dental plan, as well as reward employee loyalty by increasing vacation time to those team members who have been with the company 10+ years. To make this possible, he decides to increase the company margin from 30% to 31.5%. How will you calculate this new margin when preparing quotes?

1. (materials + labor) x .315
2. materials + (labor x .315)
3. (materials x .315) + labor
4. materials + labor + 31.5

Answer: A

2. Your company has been working with an airplane manufacturing company to fabricate a part out of plastic that used to be made of sheet metal to reduce the weight and cost. The sheet metal part was $8000/part and your company can sell it for $1200/part. In your quote, you want to add a sentence about the cost savings you are able to provide the airplane manufacturing company. Which is the accurate sentence to include in your letter?

- We are pleased to fabricate this piece of your assembly at $1200/part, which represents a cost savings of 50% over manufacturing it using sheet metal.
- We are pleased to fabricate this piece of your assembly at $1200/part, which represents a cost savings of 15% over manufacturing it using sheet metal.
- We are pleased to fabricate this piece of your assembly at $1200/part, which represents a cost savings of 75% over manufacturing it using sheet metal.
- We are pleased to fabricate this piece of your assembly at $1200/part, which represents a cost savings of 85% over manufacturing it using sheet metal.

Answer: D

3. You are working on a quote for a medical company to produce 5000 units of their chest drain made of a thin and flexible medical grade plastic. You determine that you'll need to purchase 25 pounds of silicone elastomer pellets at $6.00/lb. and that it will take 28 hours at $100/hr to complete the production run. After you add the materials and labor costs, you include a 30% margin to come up with a total price for the quote. Which of the following best expresses the total for the quote?

1. [(25 x 6) + (28 x 100) x 30] x 5000
2. [(25 x 6) + (28 x 100)] x .30
3. (25 x 6 + 28 x 100) (1 + .30)
4. 25 x 6 + 28 x 100 x .30

Answer: C

Contextualized project

Where Does the Money Go? (individual or small group)

Project Description
When customers purchase products, they pay a great deal more than the cost to manufacture that product. Why do students think that is "where does the money go?" This project builds from the contextualized problem 1 in this module where students found the cost to manufacture bicycle replacement straps for a company that specializes in bike racks for cars. Students will create a chart that provides a possible break down for the retail cost of the product and write 1-2 paragraphs to explain their thinking. To get started, it may be helpful to brainstorm as a class some categories of what it costs to sell a product: manufacturing, advertising, packaging, profit,

corporate tax, sales, product design, etc. This project gives students an opportunity to apply the math skills of addition and percentages, as well as develop the CCSS-M Practice of reasoning abstractly and quantitatively.

Assessment
Look for student's ability to create a list of numbers that adds up to the retail price, as well as their reasoning about how a price of a product is determined by a variety of categories. Also make sure that students mathematically figure out that the straps were priced individually by the manufacturer, but sold in pairs by the 2LEE company.

Project Steps

1. With this project, you will continue to work with the pricing data you computed for to manufacture replacement bicycle straps for car racks. However, this time you will imagine you work for the 2LEE company and you need to break down the costs to provide a rationale for the retail price of the straps.
2. Begin by searching the Internet for the retail price of bicycle replacement straps.
3. Create a chart that breaks down the retail cost of the product making sure that all the items total to the retail price. You have already found the manufacturing cost (as a reminder, it costs $1.49 to manufacture one strap), what other costs does a company incur? You also learned that the cost to manufacture a product can be broken down into materials, labor, and margin. Do you think that the company that sells the product has the same categories? Do they have additional categories?
4. After creating your chart, write 1-2 paragraphs of text to explain your thinking about how you broke down the cost. Make sure to share the profit margin for the 2LEE company (both percentage and dollar amount) and your rationale for this margin.

Additional or extension activities, multimedia, readings and/or resources

The Graduate "One Word: Plastics"
http://www.youtube.com/watch?v=PSxihhBzCjk
This short clip is from the classic 1967 movie, The Graduate, and shows Dustin Hoffman's character getting job advice about the future of plastics. This clip could be a fun way to introduce the plastics manufacturing context to students.

Careers in Manufacturing: Plastics (6:59)
http://www.youtube.com/watch?v=4hge9lWc5as
This video discusses plastics manufacturing in Massachusetts, and the types of jobs that are available, and can be shown to help students become interested in this field.

Plastics: A White Canvas
http://www.youtube.com/watch?v=f681iH-lBt0
This video was created by students in the University of Massachusetts' Lowell plastics program and won first place in a competition. It provides a video timeline of plastics manufacturing.