14-1 Computing the Prime Cost

The production department of a company makes, or **manufactures,** the products it sells. The cost of manufacturing an item depends on the **direct material cost,** which is the cost of the goods used to produce the item, and the **direct labor cost,** which is the cost of paying the employees who make the item. The **prime cost** is the sum of the direct material cost and the direct labor cost, and is often expressed on a per-unit basis.

Example

Find the prime cost.

Al Torre makes o-rings for the military. Each strip of metal produces 120 rings and costs $2.98. Torre can produce 48 rings per hour. The direct labor cost is $17.50 per hour. What is the prime cost of making 1 o-ring?

1. Find the direct material cost.
   $2.98 ÷ 120 = $0.025 per ring

2. Find the direct labor cost.
   $17.50 ÷ 48 = $0.365 per ring

3. Find the prime cost.
   Prime Cost per Item = Direct Material Cost per Item + Direct Labor Cost per Item
   $0.025 + $0.365 = **$0.39 per ring**

Practice

Find the direct material cost, the direct labor cost, and the prime cost.

	Cost per Strip	Pieces per Strip	Direct Material Cost per Piece	Labor Cost per Hour	Pieces Molded	Direct Labor Cost per Piece	Prime Cost
1.	$1.19	12	a.	$12.00	30/hr	b.	c.
2.	1.75	29	a.	15.50	57/hr	b.	c.
3.	2.86	41	a.	18.27	3/min	b.	c.
4.	2.27	33	a.	17.43	1/sec	b.	c.

5. Ben Shah is a plastic molder for Advanced Plastics. He can mold 325 cups from 1 container of plastic. Each container of plastic costs $3.95. Shah's machine molds 2 cups every 5 minutes. The direct labor cost is $14.29 per hour. What is the prime cost per cup?

6. **Standardized Test Practice** Amy Van Pelt works for Valley Tarp, a manufacturer of plastic tarps. Each roll of plastic costs $27.75 and produces 96 tarps. Van Pelt can cut 1 tarp every 20 seconds. The direct labor charge is $17.21 per hour. What is the prime cost per tarp?

   A. $0.289   **B.** $0.096   **C.** $6.026   **D.** $0.385

14-2 Calculating the Break-Even Point

A **break-even analysis** determines how many units of a product must be made and sold to cover production costs. The **break-even point** on a chart shows you the exact point where income from sales equals the cost of production. Any units sold *after* this point result in a **profit** for your business. To calculate the break-even point you must know the total **fixed costs,** like rent and salaries, and the total **variable costs,** which vary with the number of units produced.

Example

Find the break-even point in units.

Ace Manufacturing produces o-rings for the military. It plans to manufacture 433,000 o-rings to be sold at $0.40 apiece. The fixed costs are estimated at $114,000. Variable costs are $0.085 per unit. How many o-rings must be sold for Ace to break even?

1. Find the break-even point.
   Break-Even Point in Units = Total Fixed Costs ÷ (Selling Price per Unit − Variable Costs per Unit)
   $114,000 ÷ ($0.40 − $0.085) = $114,000 ÷ $0.315 = **361,905 units**

Practice

Find the break-even point.

	Total Fixed Costs	Selling Price per Unit	Variable Costs per Unit	Break-Even Point in Units
1.	$127,000	$0.98	$0.36	
2.	139,500	0.72	0.51	
3.	188,750	1.63	1.19	
4.	223,392	4.26	3.38	

5. Webb Manufacturing produces metal washers. The selling price per washer is $0.18. The variable cost per washer is $0.09. Fixed costs total $357,000. What is the break-even point in number of washers?

6. Advanced Plastics makes plastic cups. The cups sell for $2.29 each. The variable costs per cup include $0.79 for supplies and $1.01 for direct labor. Fixed costs total $575,000. What is the break-even point in number of cups?

7. Simplified Homes manufactures modular homes. The fixed costs total $1,332,477. The base price of each home is $135,000 and the base variable cost is $99,531 per home. What is the break-even point in number of modular homes?

8. **Standardized Test Practice** Valley Tarp manufactures plastic tarps. It has total fixed costs of $817,359. The selling price of each tarp is $21.95. The variable cost per tarp is $12.17. What is the break-even point in number of tarps?
   A. 37,237   **B.** 67,162   **C.** 83,575   **D.** 817,359

Student _____ Date _____ Period _____

14-3 Computing the Percent of Defective Goods

A **quality control** inspector checks mass-produced items. An item that's the wrong size or damaged is classified as **defective.** A **quality control chart** shows the percent of defective items allowable. The production process is said to be "out of control" if the actual percent of defective items is greater than the percent allowable.

Example

Determine if the process is in or out of control.

Ace Manufacturing produces o-rings for the military. The quality control inspector checked 75 rings and found 4 that were defective. The process is "out of control" if more than 4 percent of the sample is defective.

1. Find the percent defective.
   Percent Defective = Number Defective ÷ Total Number Checked
   4 ÷ 75 = 5.33%

2. Compare the percent defective to the percent allowable.
   5.33% is more than 4%. **The process is out of control.**

Practice

Find the percent defective and if the process is in or out of control. If more than 4.5 percent is defective, the process is out of control.

	Number Defective	Number Checked	Percent Defective	In or Out of Control
1.	3	125	a.	b.
2.	6	125	a.	b.
3.	4	150	a.	b.
4.	7	150	a.	b.

5. Twice a day Tanisha Williams inspects metal washers for defects. Her last check yielded 47 defective washers out of 1,200. If more than 4 percent is defective, the process is out of control. What is the percent defective? Is the process in or out of control?

6. **Standardized Test Practice** Every 2 hours the quality control inspector at Valley Tarp checks a random sample of 48 tarps for defects. The process is considered out of control if more that 5 percent are defective. Yesterday she got the following results: 9 A.M.—1 defective; 11 A.M.—3 defective; 1 P.M.—1 defective; 3 P.M.—2 defective; 5 P.M.—4 defective. How many times was the process out of control?
   A. Once   **B.** Twice   **C.** Three times   **D.** None

14-4 Computing Number of Units Produced

A **time study** is conducted to determine how long a particular job should take. It involves watching an employee complete a job, recording the time required for each task, and calculating the average time for each task. Averages from these results can then be used to determine how many units a worker can produce in a fixed period of time.

Example

Find the number of units.

Al Torre makes o-rings for the military. He works 9 hours per day with a half hour off for lunch and 4 10-minute breaks. He spends 3 minutes producing each ring. How many rings should Torre be able to produce each day?

1. Find the actual time worked.
   [(9 hrs × 60 min/hr) − 30 min − (4 × 10 min)] = 470 minutes

2. Find the number of units.
   Number of Units = Actual Time Worked ÷ Average Time Required per Unit
   470 min ÷ 3 min = **156.67 rings**

Practice

Find the number of units produced.

	Actual Time Worked	Average Time per Unit	Number of Units
1.	60 seconds	2.5 seconds	
2.	20 minutes	45.5 seconds	
3.	1 hour	3.5 minutes	
4.	1 hour	5 seconds	

5. Sophie Cross punches washers out of metal sheets. Every 2 hours she takes a 10-minute break. She averages 50 seconds per sheet of metal. How many sheets can Cross punch every 2 hours?

6. Tran Nguyen is a plastic cup molder. Every hour he takes a 5-minute break. He averages 6.5 minutes per cup. How many cups can Nguyen mold in a 4-hour period?

7. Standardized Test Practice Stan Riddle is employed as a press operator by Valley Tarp, a manufacturer of plastic tarps. He works a 10-hour shift, 4 days a week. Every day he gets 45 minutes off for lunch and a 7-minute break 3 times a day. He averages 10.2 minutes per tarp. How many tarps can Riddle produce per week?

   A. 534   **B.** 52.35   **C.** 209.4   **D.** 261.75

14-5 Computing Percent of Time Spent on Each Task

Another important aspect of a time study is that its results can be used to determine what percentage of an employee's time is spent on various activities during a workday.

Example

Find the percentage of time spent on an activity.

A time study conducted by Smith Manufacturing showed that Nick Ramos spends a typical day on the following activities: supervising subordinates 1.5 hrs; working on the floor 3.5 hrs; doing paperwork 2 hours; taking breaks 0.5 hrs; socializing with employees 0.5 hrs. What percentage of time does Ramos spend working on the floor?

1. Find the total time.
   1.5 + 3.5 + 2 + 0.5 + 0.5 = 8 hours

2. Find the percentage of time working on the floor.
   Percentage of Time Spent on Activity = Time Spent on Activity ÷ Total Time
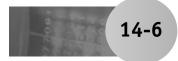   3.5 hours ÷ 8 hours = **43.75% of time spent on activity**

Practice

Find the percentage of time spent on each activity, rounded to the nearest hundredth of a percent.

	Activity	Hours	Total Hours
1.	Watching Surveillance Cameras	3.50	9
2.	Making Rounds	4.25	9
3.	Lunch	0.75	9
4.	Securing the Building	0.50	9

5. Frank Meer works as a quality control technician. A time study conducted by the company showed that Meers spent a typical day as follows: 1.25 hours conducting phone calls; 3.5 hours inspecting goods; 1 hour eating lunch; 0.5 hours socializing with employees; and 2.25 hours preparing reports. What percentage of Meer's day is spent inspecting goods?

6. Using the details outlined in Problem 5 above, what percentage of Meer's time is spent preparing reports?

7. **Standardized Test Practice** Amy Van Pelt works for Valley Tarp. A time study showed she spent a typical day as follows: 2 hours talking on the phone; 45 minutes at lunch; 15 minutes taking breaks; $1\frac{1}{4}$ hours filing; $3\frac{3}{4}$ hours doing data entry. What percentage of Van Pelt's time is spent doing data entry *and* filing?
   A. 15.63%   **B.** 46.88%   **C.** 62.5%   **D.** 37.5%

14-6 Determining the Dimensions of Packaging Cartons

Packaging is the placement of your product in a container for shipment. Careful packaging allows for ease of handling and ensures your products will arrive safely. The size of your container depends on the dimensions of your product.

Dimensions: Length, Width, Height

Example

Find the dimensions of the carton.

Light View produces halogen lights with a diameter of 25 cm and a height of 15 cm. The company plans to package 4 lights in each carton for shipping. The carton is made of 0.75-cm corrugated cardboard with 0.5-cm cardboard partitions. What are the dimensions of the package Light View needs?

1. Find the length.
   (2 lights × 25 cm diameter) + (1 partition × 0.5 cm) + (2 ends × 0.75 cm) = 52 cm

2. Find the width.
   (2 lights × 25 cm diameter) + (1 partition × 0.5 cm) + (2 ends × 0.75 cm) = 52 cm

3. Find the height.
   (1 light × 15 cm) + (2 top flaps × 0.75 cm) + (2 ends × 0.75 cm) = 18 cm

4. Find the dimensions.
   Length: 52 cm; Width: 52 cm; Height: 18 cm

Practice

Find the dimensions.

Twelve products per container (4 rows by 3 rows), each with a height of 24 inches and a diameter of 18 inches. Carton is $\frac{1}{2}$-inch corrugated cardboard with $\frac{1}{4}$-inch partitions.

Height:
1. Each product =
2. 2 flaps top + 2 flaps bottom =
3. Total height =

Width:
4. 3 products =
5. 2 partitions =
6. 2 ends =
7. Total width =

Length:
8. 4 products =
9. 3 partitions =
10. 2 ends =
11. Total length =
12. Dimensions =

13. **Standardized Test Practice** Fan Company plans to package 6 fans per box (3 long by 2 wide). Each fan has a height of 20 inches and a diameter of 12 inches. The shipping carton is composed of $\frac{1}{4}$-inch corrugated cardboard with $\frac{1}{8}$-inch partitions. What is the length of the package?

   A. $20\frac{1}{2}$ inches   **B.** $36\frac{3}{4}$ inches   **C.** $24\frac{5}{8}$ inches   **D.** $36\frac{3}{4} \times 24\frac{5}{8} \times 20\frac{1}{2}$

14 Chapter Review

Production Word Search

Fill in the blanks in each of the following clues, then find each word hidden vertically, horizontally, or diagonally in the letter grid.

1. If the size is incorrect or if an item is damaged or broken, it is said to be _____.

2. _____ is the placement of a product into a container for shipment.

3. A _____ is conducted to determine how long a particular job should take.

4. _____ costs vary directly with the number of units produced.

5. A _____ chart shows the allowable percentage of defective product.

6. The sum of the direct material costs and the direct labor costs is the _____.

7. Dimensions = _____, _____, and _____.

8. Length, width, and height are the _____ of a product.

9. The direct _____ cost is the cost of goods you use to produce an item.

10. A _____ analysis determines how many units of a product must be made and sold to cover production expenses.

11. The direct _____ cost includes the wages paid to the employees who produce an item.

12. Percentage of time spent on an activity = Time spent on activity divided by _____ time.

Z	Q	H	D	I	M	E	N	S	I	O	N	S	F	P	P	U	D
W	C	U	P	O	W	N	G	K	X	U	L	K	O	C	A	J	E
O	M	M	A	N	U	L	H	Y	R	N	W	L	W	A	C	F	F
C	B	L	A	L	T	X	V	E	D	R	I	I	I	I	K	Z	E
G	R	N	J	D	I	L	T	A	I	B	O	Q	D	X	A	F	C
M	E	M	Q	X	T	T	K	I	R	G	P	Y	T	S	G	G	T
X	A	W	U	L	R	W	Y	O	M	I	H	M	H	O	I	R	I
R	K	T	I	R	A	S	O	C	W	E	A	T	B	J	N	C	V
W	E	I	E	C	U	B	W	Y	O	D	S	B	H	A	G	Y	E
V	V	Q	E	R	O	G	O	J	Z	N	O	T	L	T	O	K	X
K	E	Z	Y	F	I	Q	X	R	N	H	T	B	U	E	H	W	Z
S	N	S	T	O	T	A	L	T	K	A	V	R	V	D	H	W	Q
L	E	N	G	T	H	X	L	Y	N	R	P	Q	O	P	Y	L	L
B	H	N	N	P	R	I	M	E	C	O	S	T	W	L	Z	Y	D