Solutions to recommended exercises

Exercise 10-10

	Quarter (000 omitted)				
	1	*2*	*3*	*4*	*Year*
Cash balance, beginning	$ 6 *	$ 5	$ 5	$ 5	$ 6
Add collections from customers	65	70	96 *	92	323 *
Total cash available	71 *	75	101	97	329
Less disbursements:					
Purchase of inventory	35 *	45 *	48	35 *	163
Selling and administrative expenses	28	30 *	30 *	25	113 *
Equipment purchases	8 *	8 *	10 *	10	36 *
Dividends	2 *	2 *	2 *	2 *	8
Total disbursements	73	85 *	90	72	320
Excess (deficiency) of cash available over disbursements	(2)*	(10)	11 *	25	9
Financing:					
Borrowings	7	15 *	0	0	22
Repayments (including interest)	0	0	(6)	(17)*	(23)
Total financing	7	15	(6)	(17)	(1)
Cash balance, ending	$ 5	$ 5	$ 5	$ 8	$ 8

*Given.

Problem 10-23

1. Collections on sales:

	April	*May*	*June*	*Quarter*
Cash sales	$120,000	$180,000	$100,000	$ 400,000
Sales on account:				
February: $200,000 × 80% × 20%	32,000			32,000
March: $300,000 × 80% × 70%, 20%	168,000	48,000		216,000
April: $600,000 × 80% × 10%, 70%, 20%	48,000	336,000	96,000	480,000
May: $900,000 × 80% × 10%, 70%		72,000	504,000	576,000
June: $500,000 × 80% × 10%			40,000	40,000
Total cash collections	$368,000	$636,000	$740,000	$1,744,000

2. a. Merchandise purchases budget:

	April	*May*	*June*	*July*
Budgeted cost of goods sold	$420,000	$630,000	$350,000	$280,000
Add desired ending inventory*	126,000	70,000	56,000	

Total needs	546,000	700,000	406,000
Less beginning inventory	84,000	126,000	70,000
Required inventory purchases	$462,000	$574,000	$336,000

*20% of the next month's budgeted cost of goods sold.

b. Schedule of expected cash disbursements for merchandise purchases:

	April	*May*	*June*	*Quarter*
Accounts payable, March 31	$126,000			$ 126,000
April purchases	231,000	$231,000		462,000
May purchases		287,000	$287,000	574,000
June purchases			168,000	168,000
Total cash disbursements	$357,000	$518,000	$455,000	$1,330,000

3.

Garden Sales, Inc.
Cash Budget
For the Quarter Ended June 30

	April	*May*	*June*	*Quarter*
Cash balance, beginning	$ 52,000	$ 40,000	$ 40,000	$ 52,000
Add collections from sales	368,000	636,000	740,000	1,744,000
Total cash available	420,000	676,000	780,000	1,796,000
Less disbursements:				
Purchases for inventory	357,000	518,000	455,000	1,330,000
Selling expenses	79,000	120,000	62,000	261,000
Administrative expenses	25,000	32,000	21,000	78,000
Land purchases	—	16,000	—	16,000
Dividends paid	49,000	—	—	49,000
Total disbursements	510,000	686,000	538,000	1,734,000
Excess (deficiency) of cash	(90,000)	(10,000)	242,000	62,000
Financing:				
Borrowings	130,000	50,000	0	180,000
Repayments	0	0	(180,000)	(180,000)
Interest ($130,000 × 1% × 3 + $50,000 × 1% × 2)	0	0	(4,900)	(4,900)
Total financing	130,000	50,000	(184,900)	(4,900)
Cash balance, ending	$ 40,000	$ 40,000	$ 57,100	$ 57,100

Problem 10-25

1. Schedule of expected cash collections:

	April		*May*	*June*	*Quarter*
Cash sales	$36,000	*	$43,200	$54,000	$133,200
Credit sales[1]	20,000	*	24,000	28,800	72,800
Total collections	$56,000	*	$67,200	$82,800	$206,000

[1]40% of the preceding month's sales.

*Given.

2. Merchandise purchases budget:

	April	*May*	*June*	*Quarter*
Budgeted cost of goods sold[1]	$45,000 *	$ 54,000 *	$67,500	$166,500
Add desired ending inventory[2]	43,200 *	54,000	28,800	28,800
Total needs	88,200 *	108,000	96,300	195,300
Less beginning inventory	36,000 *	43,200	54,000	36,000
Required purchases	$52,200 *	$ 64,800	$42,300	$159,300

[1]For April sales: $60,000 sales × 75% cost ratio = $45,000.

[2]At April 30: $54,000 × 80% = $43,200.

At June 30: July sales $48,000 × 75% cost ratio × 80% = $28,800.

*Given.

Schedule of expected cash disbursements—merchandise purchases

	April	*May*	*June*	*Quarter*
March purchases	$21,750 *			$ 21,750 *
April purchases	26,100 *	$26,100 *		52,200 *
May purchases		32,400	$32,400	64,800
June purchases			21,150	21,150
Total disbursements	$47,850 *	$58,500	$53,550	$159,900

*Given.

3. Schedule of expected cash disbursements—selling and administrative expenses

	April	*May*	*June*	*Quarter*
Commissions	$ 7,200 *	$ 8,640	$10,800	$26,640
Rent	2,500 *	2,500	2,500	7,500
Other expenses	3,600 *	4,320	5,400	13,320
Total disbursements	$13,300 *	$15,460	$18,700	$47,460

*Given.

4. Cash budget:

	April	*May*	*June*	*Quarter*
Cash balance, beginning	$ 8,000 *	$ 4,350	$ 4,590	$ 8,000
Add cash collections	56,000 *	67,200	82,800	206,000
Total cash available	64,000 *	71,550	87,390	214,000
Less disbursements:				
For inventory	47,850 *	58,500	53,550	159,900
For expenses	13,300 *	15,460	18,700	47,460
For equipment	1,500 *	0	0	1,500

Total disbursements	62,650 *	73,960	72,250	208,860
Excess (deficiency) of cash	1,350 *	(2,410)	15,140	5,140
Financing:				
Borrowings	3,000	7,000	0	10,000
Repayments	0	0	(10,000)	(10,000)
Interest ($3,000 × 1% × 3 + $7,000 × 1% × 2)	0	0	(230)	(230)
Total financing	3,000	7,000	(10,230)	(230)
Cash balance, ending	$ 4,350	$ 4,590	$ 4,910	$ 4,910

* Given.

5.

Shilow Company
Income Statement
For the Quarter Ended June 30

Sales ($60,000 + $72,000 + $90,000)		$222,000
Cost of goods sold:		
Beginning inventory (Given)	$ 36,000	
Add purchases (Part 2)	159,300	
Goods available for sale	195,300	
Ending inventory (Part 2)	28,800	166,500 *
Gross margin		55,500
Selling and administrative expenses:		
Commissions (Part 3)	26,640	
Rent (Part 3)	7,500	
Depreciation ($900 × 3)	2,700	
Other expenses (Part 3)	13,320	50,160
Net operating income		5,340
Interest expense (Part 4)		230
Net income		$ 5,110

*A simpler computation would be: $222,000 × 75% = $166,500.

Problem 10-25 (continued)

6.

Shilow Company
Balance Sheet
June 30

Assets

Current assets:		
Cash (Part 4)		$ 4,910
Accounts receivable ($90,000 × 40%)		36,000
Inventory (Part 2)		28,800
Total current assets		69,710
Building and equipment—net ($120,000 + $1,500 – $2,700)		118,800
Total assets		$188,510

Liabilities and Equity

Accounts payable (Part 2: $42,300 × 50%)		$ 21,150
Stockholders' equity:		
Capital stock (Given)	$150,000	
Retained earnings*	17,360	167,360
Total liabilities and equity		$188,510

* Retained earnings, beginning	$12,250
Add net income	5,110
Retained earnings, ending	$17,360

Solutions to recommended exercises

Exercise 11-1

Puget Sound Divers
Flexible Budget
For the Month Ended May 31

Actual diving-hours	105
Revenue ($365.00q)	$38,325
Expenses:	
Wages and salaries ($8,000 + $125.00q)	21,125
Supplies ($3.00q)	315
Equipment rental ($1,800 + $32.00q)	5,160
Insurance ($3,400)	3,400
Miscellaneous ($630 + $1.80q)	819
Total expense	30,819
Net operating income	$ 7,506

Exercise 11-2

1. The activity variances are shown below:

Flight Café
Activity Variances
For the Month Ended July 31

	Planning Budget	*Flexible Budget*	*Activity Variances*	
Meals	18,000	17,800		
Revenue ($4.50q)	$81,000	$80,100	$900	U
Expenses:				
Raw materials ($2.40q)	43,200	42,720	480	F
Wages and salaries ($5,200 + $0.30q)	10,600	10,540	60	F
Utilities ($2,400 + $0.05q)	3,300	3,290	10	F
Facility rent ($4,300)	4,300	4,300	0	
Insurance ($2,300)	2,300	2,300	0	
Miscellaneous ($680 + $0.10q)	2,480	2,460	20	F
Total expense	66,180	65,610	570	F
Net operating income	$14,820	$14,490	$330	U

2. Management should be concerned that the level of activity fell below what had been planned for the month. This led to an expected decline in profits of $330. However, the individual items on the report should not receive much management attention. The unfavorable variance for revenue and the favorable variances for expenses are entirely caused by the drop in activity.

Exercise 11-3

Quilcene Oysteria
Revenue and Spending Variances
For the Month Ended August 31

	Flexible Budget	*Actual Results*	*Revenue and Spending Variances*	
Pounds	8,000	8,000		
Revenue ($4.00q)	$32,000	$35,200	$3,200	F
Expenses:				
Packing supplies ($0.50q)	4,000	4,200	200	U
Oyster bed maintenance ($3,200)	3,200	3,100	100	F
Wages and salaries ($2,900 + $0.30q)	5,300	5,640	340	U
Shipping ($0.80q)	6,400	6,950	550	U
Utilities ($830)	830	810	20	F
Other ($450 + $0.05q)	850	980	130	U
Total expense	20,580	21,680	1,100	U
Net operating income	$11,420	$13,520	$2,100	F

Exercise 11-4

1.

Vulcan Flyovers
Flexible Budget Performance Report
For the Month Ended July 31

	Planning Budget	*Activity Variances*		*Flexible Budget*	*Revenue and Spending Variances*		*Actual Results*
Flights (q)	50			48			48
Revenue ($320.00q)	$16,000	$640	U	$15,360	$1,710	U	$13,650
Expenses:							
Wages and salaries ($4,000 + $82.00q)	8,100	164	F	7,936	494	U	8,430
Fuel ($23.00q)	1,150	46	F	1,104	156	U	1,260
Airport fees ($650 + $38.00q)	2,550	76	F	2,474	124	F	2,350
Aircraft depreciation ($7.00q)	350	14	F	336	0		336
Office expenses ($190 + $2.00q)	290	4	F	286	174	U	460
Total expense	12,440	304	F	12,136	700	U	12,836
Net operating income	$ 3,560	$336	U	$ 3,224	$2,410	U	$ 814

2. The overall $336 unfavorable activity variance is due to activity falling below what had been planned for the month. The $1,710 unfavorable revenue variance is very large relative to the company's net operating income and should be investigated. Was this due to discounts given or perhaps a lower average number of passengers per flight than usual? The $494 unfavorable spending variance for wages and salaries is also large and should be investigated. The other spending variances are relatively small, but are worth some management attention—particularly if they recur next month.

Exercise 11-5

Alyeski Tours
Planning Budget
For the Month Ended July 31

Budgeted cruises (q_1)	24
Budgeted passengers (q_2)	1,400
Revenue (25.00q_2$)	$35,000
Expenses:	
Vessel operating costs ($5,200 + 480.00q_1$ + 2.00q_2$)	19,520
Advertising ($1,700)	1,700
Administrative costs ($4,300 + 24.00q_1$ + 1.00q_2$)	6,276
Insurance ($2,900)	2,900
Total expense	30,396
Net operating income	$ 4,604

Problem 11-19

1. The variance report should *not* be used to evaluate how well costs were controlled. In July, the planning budget was based on 150 lessons, but the actual results are for 155 lessons—an increase of more than 3% over budget. Consequently, the actual revenues and many of the actual costs *should* have been different from what was budgeted at the beginning of the period. For example, instructor wages, a variable cost, should have increased by more than 3% because of the increase in activity, but the variance report assumes that they should not have increased at all. This results in a spurious unfavorable variance for instructor wages. Direct comparisons of budgeted to actual costs are valid only if the costs are fixed.
2. See the following page.
3. The overall activity variance for net operating income was $435 F (favorable). That means that as a consequence of the increase in activity from 150 lessons to 155 lessons, the net operating income should have been up $435 over budget. However, it wasn't. The budgeted net operating income was $8,030 and the actual net operating income was $8,080, so the profit was up by only $50—not $435 as it should have been. There are many reasons for this—as shown in the revenue and spending variances. Perhaps most importantly, fuel costs were much higher than expected. The spending variance for fuel was $425 U (unfavorable) and may have been due to an increase in the price of fuel that is beyond the owner/manager's control. Most of the other spending variances were favorable, so with the exception of this item, costs seem to have been adequately controlled. In addition, the unfavorable revenue variance of $200 indicates that revenue was slightly less than they should have been. This variance is very small relative to the size of the revenue, so it may not justify investigation.

Problem 11-19 (continued)

TipTop Flight School
Flexible Budget Performance Report
For the Month Ended July 31

	Planning Budget	*Activity Variances*		*Flexible Budget*	*Revenue and Spending Variances*		*Actual Results*
Lessons (q)	150			155			155
Revenue ($220q)	$33,000	$1,100	F	$34,100	$200	U	$33,900
Expenses:							
Instructor wages ($65q)	9,750	325	U	10,075	205	F	9,870
Aircraft depreciation ($38q)	5,700	190	U	5,890	0		5,890
Fuel ($15q)	2,250	75	U	2,325	425	U	2,750
Maintenance ($530 + $12q)	2,330	60	U	2,390	60	U	2,450
Ground facility expenses ($1,250 + $2q)	1,550	10	U	1,560	20	F	1,540
Administration ($3,240 + $1q)	3,390	5	U	3,395	75	F	3,320
Total expense	24,970	665	U	25,635	185	U	25,820
Net operating income	$ 8,030	$ 435	F	$ 8,465	$385	U	$ 8,080

Solutions to recommended exercises

Exercise 12-1

1.

Number of helmets	35,000
Standard kilograms of plastic per helmet	× 0.6
Total standard kilograms allowed	21,000
Standard cost per kilogram	× RM8
Total standard cost	RM168,000
Actual cost incurred (given)	RM171,000
Total standard cost (above)	168,000
Total material variance—unfavorable	RM 3,000

2.

Actual Quantity of Input, at Actual Price (AQ × AP)	Actual Quantity of Input, at Standard Price (AQ × SP)	Standard Quantity Allowed for Output, at Standard Price (SQ × SP)
	22,500 kilograms × RM8 per kilogram	21,000 kilograms* × RM8 per kilogram
RM171,000	= RM180,000	= RM168,000

Price Variance, RM9,000 F

Quantity Variance, RM12,000 U

Total Variance, RM3,000 U

*35,000 helmets × 0.6 kilograms per helmet = 21,000 kilograms

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP − SP)
= 22,500 kilograms (RM7.60 per kilogram# − RM8.00 per kilogram)
= RM9,000 F

RM171,000 ÷ 22,500 kilograms = RM7.60 per kilogram

Materials quantity variance = SP (AQ − SQ)
= RM8 per kilogram (22,500 kilograms − 21,000 kilograms)
= RM12,000 U

Alternatively, the variances can also be computed in the following:

AQ x AP = **171,000**

AQ x SP **22,500** **x 8** = **180,000**

SQ x SP (**35,000 x 0.6**) **x 8** = **168,000**

(**9,000**) **F** [**Price**]

12,000 U [**Quantity**]

	3,000 U [Total]

Exercise 12-2

1.

Number of meals prepared	4,000
Standard direct labor-hours per meal	× 0.25
Total direct labor-hours allowed	1,000
Standard direct labor cost per hour	× $9.75
Total standard direct labor cost	$9,750
Actual cost incurred	$9,600
Total standard direct labor cost (above)	9,750
Total direct labor variance	$ 150 Favorable

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
960 hours × $10.00 per hour = $9,600	960 hours × $9.75 per hour = $9,360	1,000 hours × $9.75 per hour = $9,750

Rate Variance, $240 U

Efficiency Variance, $390 F

Total Variance, $150 F

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH(AR – SR)
= 960 hours ($10.00 per hour – $9.75 per hour)
= $240 U

Labor efficiency variance = SR(AH – SH)
= $9.75 per hour (960 hours – 1,000 hours)
= $390 F

Alternatively, the variances can also be computed in the following:

AH x AR	**960**	**x 10**	= **9,600**	**240 U [Rate]**
AH x SR	**960**	**x 9.75**	= **9,360**	**(390) F [Efficiency]**
SH x SR	**(4,000 x 0.25)**	**x 9.75**	= **9,750**	**(150) F [Total]**

Exercise 12-3

1.

Number of items shipped	120,000
Standard direct labor-hours per item	× 0.02
Total direct labor-hours allowed	2,400
Standard variable overhead cost per hour	× $3.25
Total standard variable overhead cost	$ 7,800
Actual variable overhead cost incurred	$7,360
Total standard variable overhead cost (above)	7,800
Total variable overhead variance	$ 440 Favorable

2.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
2,300 hours × $3.20 per hour* = $7,360	2,300 hours × $3.25 per hour = $7,475	2,400 hours × $3.25 per hour = $7,800

Variable Overhead Rate Variance, $115 F

Variable Overhead Efficiency Variance, $325 F

Total Variance, $440 F

*$7,360 ÷ 2,300 hours = $3.20 per hour

Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance:

AH(AR – SR) = 2,300 hours ($3.20 per hour – $3.25 per hour)
= $115 F

Variable overhead efficiency variance:

SR(AH – SH) = $3.25 per hour (2,300 hours – 2,400 hours)
= $325 F

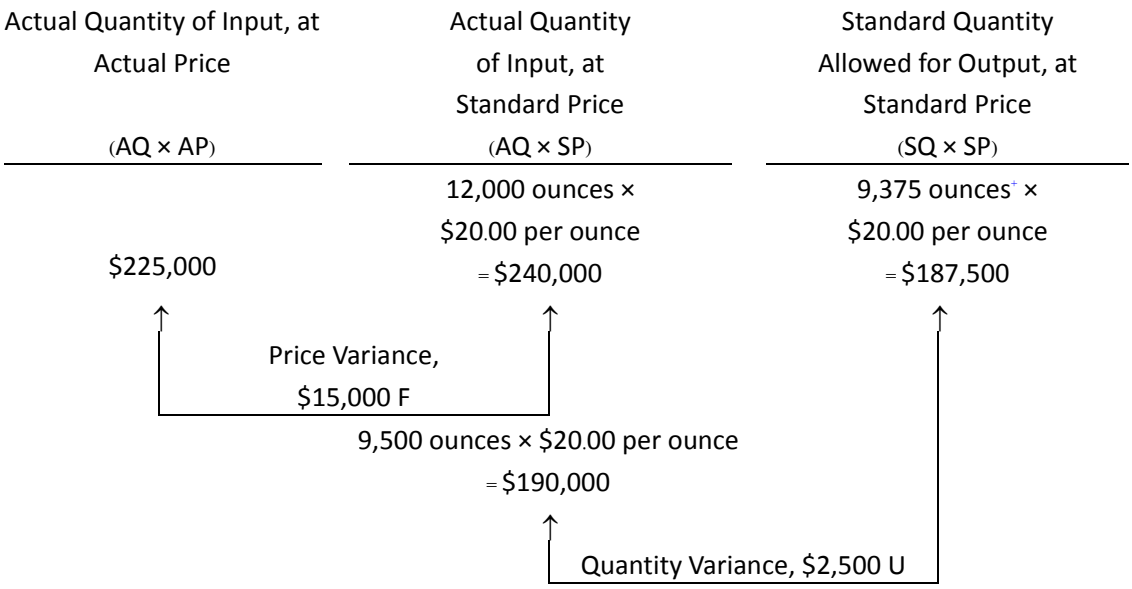
Alternatively, the variances can also be computed in the following:

AH x AR	**2,300**	**x 3.20** = **7,360**	(**115**) **F** [**Rate**]
AH x SR	**2,300**	**x 3.25** = **7,475**	(**325**) **F** [**Efficiency**]

SH x SR	(120,000 x 0.02)	x 3.25	= 7,800	
				(440) F [Total]

Problem 12-9

1. a. In the solution below, the materials price variance is computed on the entire amount of materials purchased whereas the materials quantity variance is computed only on the amount of materials used in production:



+3,750 units × 2.5 ounces per unit = 9,375 ounces

Alternatively, the variances can be computed using the formulas:

Materials price variance = AQ (AP – SP)
12,000 ounces ($18.75 per ounce# – $20.00 per ounce) = $15,000 F

#$225,000 ÷ 12,000 ounces = $18.75 per ounce

Materials quantity variance = SP (AQ – SQ)
$20.00 per ounce (9,500 ounces – 9,375 ounces) = $2,500 U

Alternatively, the variances can also be computed in the following:

AQ_p x AP			= **225,000**	
AQ_p x SP	**12,000**	**x 20**	= **240,000**	(**15,000**) **F** [**Price**]
AQ_u x SP	**9,500**	**x 20**	= **190,000**	**50,000 U** [**Inventory**]
SQ_u x SP	(**3,750 x 2.5**)	**x 20**	= **187,500**	**2,500 U** [**Quantity**]
				37,500 U [**Total**]

b. Yes, the contract probably should be signed. The new price of $18.75 per ounce is substantially lower than the old price of $20.00 per ounce, resulting in a favorable price variance of $15,000 for the month. Moreover, the material from the new supplier appears to cause little or no

problem in production as shown by the small materials quantity variance for the month.

2. a.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
5,600 hours* × $12.00 per hour = $67,200	5,600 hours × $12.50 per hour = $70,000	5,250 hours** × $12.50 per hour = $65,625

Rate Variance, $2,800 F

Efficiency Variance, $4,375 U

Total Variance, $1,575 U

*35 technicians × 160 hours per technician = 5,600 hours

**3,750 units × 1.4 hours per technician = 5,250 hrs

Alternatively, the variances can be computed using the formulas:

Labor rate variance = AH (AR – SR)
5,600 hours ($12.00 per hour – $12.50 per hour) = $2,800 F

Labor efficiency variance = SR (AH – SH)
$12.50 per hour (5,600 hours – 5,250 hours) = $4,375 U

Alternatively, the variances can also be computed in the following:

AH x AR	**(35 x 160) x 12.0 = 67,200**	→	**(2,800) F [Rate]**
AH x SR	**5,600 x 12.5 = 70,000**	→	**4,375 U [Efficiency]**
SH x SR	**(3,750 x 1.4) x 12.5 = 65,625**		
			1,575 U [Total]

Problem 12-9 (continued)

b. No, the new labor mix probably should not be continued. Although it decreases the average hourly labor cost from $12.50 to $12.00, thereby causing a $2,800 favorable labor rate variance, this savings is more than offset by a large unfavorable labor efficiency variance for the month. Thus, the new labor mix increases overall labor costs.

3.

Actual Hours of Input, at the Actual Rate (AH × AR)	Actual Hours of Input, at the Standard Rate (AH × SR)	Standard Hours Allowed for Output, at the Standard Rate (SH × SR)
	5,600 hours* × $3.50 per hour = $19,600	5,250 hours** × $3.50 per hour = $18,375
$18,200		

Rate Variance, $1,400 F

Efficiency Variance, $1,225 U

Total Variance, $175 F

* Based on direct labor hours:

35 technicians × 160 hours per technician = 5,600 hours

** 3,750 units × 1.4 hours per unit = 5,250 hours

Alternatively, the variances can be computed using the formulas:

Variable overhead rate variance = AH (AR – SR)

5,600 hours ($3.25 per hour^^ – $3.50 per hour) = $1,400 F

^^$18,200 ÷ 5,600 hours = $3.25 per hour

Variable overhead efficiency variance = SR (AH – SH)

$3.50 per hour (5,600 hours – 5,250 hours) = $1,225 U

Both the labor efficiency variance and the variable overhead efficiency variance are computed by comparing actual labor-hours to standard labor-hours. Thus, if the labor efficiency variance is unfavorable, then the variable overhead efficiency variance will be unfavorable as well.

Alternatively, the variances can also be computed in the following:

AH x AR			= **18,200**	
AH x SR	**5,600**	**x 3.5**	= **19,600**	(**1,400**) **F** [**Rate**]
SH x SR	(**3,750 x 1.4**)	**x 3.5**	= **18,375**	**1,225 U** [**Efficiency**]
				(**175**) **F** [**Total**]

Solutions to recommended exercises

Exercise 13-1

	Total	*Weedban*	*Greengrow*
Sales*	$300,000	$90,000	$210,000
Variable expenses**	183,000	36,000	147,000
Contribution margin	117,000	54,000	63,000
Traceable fixed expenses	66,000	45,000	21,000
Product line segment margin	51,000	$ 9,000	$ 42,000
Common fixed expenses not traceable to products	33,000		
Net operating income	$ 18,000		

* Weedban: 15,000 units × $6.00 per unit = $90,000.
Greengrow: 28,000 units × $7.50 per unit = $210,000.

** Weedban: 15,000 units × $2.40 per unit = $36,000.
Greengrow: 28,000 units × $5.25 per unit = $147,000.

Exercise 13-2

1. $$\text{Margin} = \frac{\text{Net operating income}}{\text{Sales}}$$
$$= \frac{\$600,000}{\$7,500,000} = 8\%$$

2. $$\text{Turnover} = \frac{\text{Sales}}{\text{Average operating assets}}$$
$$= \frac{\$7,500,000}{\$5,000,000} = 1.5$$

3. $$\text{ROI} = \text{Margin} \times \text{Turnover}$$
$$= 8\% \times 1.5 = 12\%$$

Exercise 13-3

Average operating assets.....	£2,800,000
Net operating income	£ 600,000
Minimum required return:	
18% × £2,800,000.....	504,000
Residual income.....	£ 96,000

Exercise 13-4

1. Throughput time = Process time + Inspection time + Move time + Queue time
   = 2.7 days + 0.3 days + 1.0 days + 5.0 days
   = 9.0 days

2. Only process time is value-added time; therefore the manufacturing cycle efficiency (MCE) is:

$$\text{MCE} = \frac{\text{Value-added time}}{\text{Throughput time}} = \frac{2.7 \text{ days}}{9.0 \text{ days}} = 0.30$$

3. If the MCE is 30%, then 30% of the throughput time was spent in value-added activities. Consequently, the other 70% of the throughput time was spent in non-value-added activities.

4. Delivery cycle time = Wait time + Throughput time
   = 14.0 days + 9.0 days
   = 23.0 days

5. If all queue time is eliminated, then the throughput time drops to only 4 days (2.7 + 0.3 + 1.0). The MCE becomes:

$$\text{MCE} = \frac{\text{Value-added time}}{\text{Throughput time}} = \frac{2.7 \text{ days}}{4.0 \text{ days}} = 0.675$$

   Thus, the MCE increases to 67.5%. This exercise shows quite dramatically how lean production can improve the efficiency of operations and reduce throughput time.

Exercise 13-6

1. ROI computations:

$$\text{ROI} = \text{Margin} \times \text{Turnover}$$

$$= \frac{\text{Net operating income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average operating assets}}$$

Osaka Division:

$$\text{ROI} = \frac{¥210{,}000}{¥3{,}000{,}000} \times \frac{¥3{,}000{,}000}{¥1{,}000{,}000}$$

$$= 7\% \times 3 = 21\%$$

Yokohama Division:

$$\text{ROI} = \frac{¥720{,}000}{¥9{,}000{,}000} \times \frac{¥9{,}000{,}000}{¥4{,}000{,}000}$$

$$= 8\% \times 2.25 = 18\%$$

2.

	Osaka	*Yokohama*
Average operating assets (a)	¥1,000,000	¥4,000,000
Net operating income	¥ 210,000	¥ 720,000
Minimum required return on average operating assets: 15% × (a)	150,000	600,000
Residual income	¥ 60,000	¥ 120,000

3. No, the Yokohama Division is simply larger than the Osaka Division and for this reason one would expect that it would have a greater amount of residual income. Residual income can't be used to compare the performance of divisions of different sizes. Larger divisions will almost always look better. In fact, in the case above, the Yokohama Division does not appear to be as well managed as the Osaka Division. Note from Part (1) that Yokohama has only an 18% ROI as compared to 21% for Osaka.

Problem 13-18

1.

	Present	*New Line*		*Total*
(1) Sales	$10,000,000	$2,000,000		$12,000,000
(2) Net operating income	$800,000	$160,000	*	$960,000
(3) Operating assets	$4,000,000	$1,000,000		$5,000,000
(4) Margin (2) ÷ (1)	8%	8%		8%
(5) Turnover (1) ÷ (3)	2.5	2.0		2.4
(6) ROI (4) × (5)	20.0%	16.0%		19.2%

*	Sales	$2,000,000
	Variable expenses (60% × $2,000,000)	1,200,000
	Contribution margin	800,000
	Fixed expenses	640,000
	Net operating income	$ 160,000

2. Dell Havasi will be inclined to reject the new product line because accepting it would reduce his division's overall rate of return.

3. The new product line promises an ROI of 16%, whereas the company's overall ROI last year was only 15%. Thus, adding the new line would increase the company's overall ROI.

4. a.

	Present	*New Line*	*Total*
Operating assets	$4,000,000	$1,000,000	$5,000,000
Minimum return required	× 12%	× 12%	× 12%
Minimum net operating income	$ 480,000	$ 120,000	$ 600,000
Actual net operating income	$ 800,000	$ 160,000	$ 960,000
Minimum net operating income (above)	480,000	120,000	600,000
Residual income	$ 320,000	$ 40,000	$ 360,000

b. Under the residual income approach, Dell Havasi would be inclined to accept the new product line because adding the product line would increase the total amount of his division's residual income, as shown above.

Solutions to recommended exercises

Exercise 14-1

		Case 1		*Case 2*	
	Item	*Relevant*	*Not Relevant*	*Relevant*	*Not Relevant*
a.	Sales	X			X
b.	Direct materials	X		X	
c.	Direct labor	X			X
d.	Variable manufacturing overhead	X			X
e.	Depreciation—Model B100 machine		X		X
f.	Book value—Model B100 machine		X		X
g.	Disposal value—Model B100 machine		X	X	
h.	Market value—Model B300 machine (cost)	X		X	
i.	Fixed manufacturing overhead		X		X
j.	Variable selling expense	X			X
k.	Fixed selling expense	X			X
l.	General administrative overhead	X			X

Exercise 14-2

1. No, production and sale of the racing bikes should not be discontinued. If the racing bikes were discontinued, then the net operating income for the company as a whole would decrease by $11,000 each quarter:

Lost contribution margin		$(27,000)
Fixed costs that can be avoided:		
Advertising, traceable	$ 6,000	
Salary of the product line manager	10,000	16,000
Decrease in net operating income for the company as a whole		$(11,000)

The depreciation of the special equipment is a sunk cost and is not relevant to the decision. The common costs are allocated and will continue regardless of whether or not the racing bikes are discontinued; thus, they are not relevant to the decision.

Exercise 14-2 Alternative Solution:

	Current Total	*Total If Racing Bikes Are Dropped*	*Difference: Net Operating Income Increase or (Decrease)*
Sales	$300,000	$240,000	$(60,000)
Variable expenses	120,000	87,000	33,000
Contribution margin	180,000	153,000	(27,000)
Fixed expenses:			
Advertising, traceable	30,000	24,000	6,000
Depreciation on special equipment*	23,000	23,000	0
Salaries of product managers	35,000	25,000	10,000
Common allocated costs	60,000	60,000	0
Total fixed expenses	148,000	132,000	16,000
Net operating income	$ 32,000	$ 21,000	$(11,000)

*Includes pro-rated loss on the special equipment if it is disposed of.

2. The segmented report can be improved by eliminating the allocation of the common fixed expenses. Following the format introduced in Chapter 13 for a segmented income statement, a better report would be:

	Total	*Dirt Bikes*	*Mountain Bikes*	*Racing Bikes*
Sales	$300,000	$90,000	$150,000	$60,000
Variable manufacturing and selling expenses	120,000	27,000	60,000	33,000
Contribution margin	180,000	63,000	90,000	27,000
Traceable fixed expenses:				
Advertising	30,000	10,000	14,000	6,000
Depreciation of special equipment	23,000	6,000	9,000	8,000
Salaries of the product line managers	35,000	12,000	13,000	10,000
Total traceable fixed expenses	88,000	28,000	36,000	24,000
Product line segment margin	92,000	$35,000	$ 54,000	$ 3,000
Common fixed expenses	60,000			
Net operating income	$ 32,000			

Exercise 14-3

1.

	Per Unit Differential Costs		*15,000 units*	
	Make	*Buy*	*Make*	*Buy*
Cost of purchasing		$35		$525,000
Direct materials	$14		$210,000	
Direct labor	10		150,000	
Variable manufacturing overhead	3		45,000	
Fixed manufacturing overhead, traceable[1]	2		30,000	
Fixed manufacturing overhead, common				
Total costs	$29	$35	$435,000	$525,000
Difference in favor of continuing to make the carburetors	$6		$90,000	

[1] Only the supervisory salaries can be avoided if the carburetors are purchased. The remaining book value of the special equipment is a sunk cost; hence, the $4 per unit depreciation expense is not relevant to this decision.

Based on these data, the company should reject the offer and should continue to produce the carburetors internally.

2.

	Make	*Buy*
Cost of purchasing (part 1)		$525,000
Cost of making (part 1)	$435,000	
Opportunity cost—segment margin foregone on a potential new product line	150,000	
Total cost	$585,000	$525,000
Difference in favor of purchasing from the outside supplier	$60,000	

Thus, the company should accept the offer and purchase the carburetors from the outside supplier.

Exercise 14-4

Only the incremental costs and benefits are relevant. In particular, only the variable manufacturing overhead and the cost of the special tool are relevant overhead costs in this situation. The other manufacturing overhead costs are fixed and are not affected by the decision.

	Per Unit	*Total for 20 Bracelets*
Incremental revenue	$169.95	$3,399.00
Incremental costs:		
Variable costs:		
Direct materials	$ 84.00	1,680.00
Direct labor	45.00	900.00
Variable manufacturing overhead	4.00	80.00
Special filigree	2.00	40.00
Total variable cost	$135.00	2,700.00
Fixed costs:		
Purchase of special tool		250.00
Total incremental cost		2,950.00
Incremental net operating income		$ 449.00

Even though the price for the special order is below the company's regular price for such an item, the special order would add to the company's net operating income and should be accepted. This conclusion would not necessarily follow if the special order affected the regular selling price of bracelets or if it required the use of a constrained resource.

Exercise 14-5

1.

		A	*B*	*C*
(1)	Contribution margin per unit	$54	$108	$60
(2)	Direct material cost per unit	$24	$72	$32
(3)	Direct material cost per pound	$8	$8	$8
(4)	Pounds of material required per unit (2) ÷ (3)	3	9	4
(5)	Contribution margin per pound (1) ÷ (4)	$18	$12	$15

2. The company should concentrate its available material on product A:

	A	*B*	*C*
Contribution margin per pound (above)	$ 18	$ 12	$ 15
Pounds of material available	× 5,000	× 5,000	× 5,000
Total contribution margin	$90,000	$60,000	$75,000

Although product A has the lowest contribution margin per unit and the second lowest contribution margin ratio, it is preferred over the other two products because it has the greatest amount of contribution margin per pound of material, and material is the company's constrained resource.

3. The price Barlow Company would be willing to pay per pound for additional raw materials depends on how the materials would be used. If there are unfilled orders for all of the products, Barlow would presumably use the additional raw materials to make more of product A. Each pound of raw materials used in product A generates $18 of contribution margin over and above the usual cost of raw materials. Therefore, Barlow should be willing to pay up to $26 per pound ($8 usual price plus $18 contribution margin per pound) for the additional raw material, but would of course prefer to pay far less. The upper limit of $26 per pound to manufacture more product A signals to managers how valuable additional raw materials are to the company.

If all of the orders for product A have been filled, Barlow Company would then use additional raw materials to manufacture product C. The company should be willing to pay up to $23 per pound ($8 usual price plus $15 contribution margin per pound) for the additional raw materials to manufacture more product C, and up to $20 per pound ($8 usual price plus $12 contribution margin per pound) to manufacture more product B if all of the orders for product C have been filled as well.

Exercise 14-6

	A	*B*	*C*
Selling price after further processing	$20	$13	$32
Selling price at the split-off point	16	8	25
Incremental revenue per pound or gallon	$ 4	$ 5	$ 7
Total quarterly output in pounds or gallons	×15,000	×20,000	×4,000
Total incremental revenue	$60,000	$100,000	$28,000
Total incremental processing costs	63,000	80,000	36,000
Total incremental profit or loss	$(3,000)	$ 20,000	$(8,000)

Therefore, only product B should be processed further.

Problem 14-23 (60 minutes)

1. Selling price per unit $32
   Variable expenses per unit ..... 18 *
   Contribution margin per unit $14

   *$10.00 + $4.50 + $2.30 + $1.20 = $18.00

   Increased sales in units (60,000 units × 25%) 15,000
   Contribution margin per unit ..... × $14
   Incremental contribution margin $210,000
   Less added fixed selling expenses 80,000
   Incremental net operating income $130,000

   Yes, the increase in fixed selling expenses would be justified.

2. Variable manufacturing cost per unit ..... $16.80 *
   Import duties per unit 1.70
   Permits and licenses ($9,000 ÷ 20,000 units) 0.45
   Shipping cost per unit 3.20
   Break-even price per unit $22.15

   *$10 + $4.50 + $2.30 = $16.80.

3. The relevant cost is $1.20 per unit, which is the variable selling expense per Dak. Because the irregular units have already been produced, all production costs (including the variable production costs) are sunk. The fixed selling expenses are not relevant because they will be incurred whether or not the irregular units are sold. Depending on how the irregular units are sold, the variable expense of $1.20 per unit may not even be relevant. For example, the units may be disposed of through a liquidator without incurring the normal variable selling expense.

4. If the plant operates at 30% of normal levels, then only 3,000 units will be produced and sold during the two-month period:

   60,000 units per year × 2/12 = 10,000 units.
   10,000 units × 30% = 3,000 units produced and sold.

Problem 14-23

Given this information, the simplest approach to the solution is:

Contribution margin lost if the plant is closed (3,000 units × $14 per unit*)		$(42,000)
Fixed costs that can be avoided if the plant is closed:		
Fixed manufacturing overhead cost ($300,000 × 2/12 = $50,000; $50,000 × 40%)	$20,000	
Fixed selling cost ($210,000 × 2/12 = $35,000; $35,000 × 20%)	7,000	27,000
Net disadvantage of closing the plant		$(15,000)

*$32.00 – ($10.00 + $4.50 + $2.30 + $1.20) = $14.00

Some students will take a longer approach such as that shown below:

	Continue to Operate	*Close the Plant*
Sales (3,000 units × $32 per unit)	$ 96,000	$ 0
Variable expenses (3,000 units × $18 per unit)	54,000	0
Contribution margin	42,000	0
Fixed expenses:		
Fixed manufacturing overhead cost:		
$300,000 × 2/12	50,000	
$300,000 × 2/12 × 60%		30,000
Fixed selling expense:		
$210,000 × 2/12	35,000	
$210,000 × 2/12 × 80%		28,000
Total fixed expenses	85,000	58,000
Net operating income (loss)	$(43,000)	$(58,000)

5. The relevant costs are those that can be avoided by purchasing from the outside manufacturer. These costs are:

Variable manufacturing costs	$16.80
Fixed manufacturing overhead cost ($300,000 × 75% = $225,000; $225,000 ÷ 60,000 units)	3.75
Variable selling expense ($1.20 × 1/3)	0.40
Total costs avoided	$20.95

To be acceptable, the outside manufacturer's quotation must be *less* than $20.95 per unit.

Solutions to recommended exercises

Exercise 15-1 (10 minutes)

1.

	Now	1	2	3	4	5
Purchase of machine	$(27,000)					
Reduced operating costs		$7,000	$7,000	$7,000	$7,000	$7,000
Total cash flows (a)	$(27,000)	$7,000	$7,000	$7,000	$7,000	$7,000
Discount factor (12%) (b)	1.000	0.893	0.797	0.712	0.636	0.567
Present value (a)×(b)	$(27,000)	$6,251	$5,579	$4,984	$4,452	$3,969
Net present value	$(1,765)					

Note: The annual reduction in operating costs can also be converted to its present value using the discount factor of 3.605 as shown in Exhibit 15B-2 in Appendix 15B.

2.

Item	*Cash Flow*	*Years*	*Total Cash Flows*
Annual cost savings	$7,000	5	$ 35,000
Initial investment	$(27,000)	1	(27,000)
Net cash flow			$ 8,000

Exercise 15-2

1. Annual savings in part-time help $3,800
   Added contribution margin from expanded sales (1,000 dozen × $1.20 per dozen) 1,200
   Annual cash inflows $5,000

2. $$\text{Factor of the internal rate of return} = \frac{\text{Investment required}}{\text{Annual cash inflow}}$$
$$= \frac{\$18,600}{\$5,000} = 3.720$$

   Looking in Exhibit 15B-2, a factor of 3.720 falls closest to the 16% rate of return.

3. The cash flows will not be even over the six-year life of the machine because of the extra $9,125 inflow in the sixth year. Therefore, the above approach cannot be used to compute the internal rate of return in this situation. Using trial-and-error or some other method, the internal rate of is 22%:

	Now	1	2	3	4	5	6
Purchase of machine	$(18,600)						
Reduced part-time help		$3,800	$3,800	$3,800	$3,800	$3,800	$3,800
Added contribution margin		1,200	1,200	1,200	1,200	1,200	1,200
Salvage value of machine							9,125
Total cash flows (a)	$(18,600)	$5,000	$5,000	$5,000	$5,000	$5,000	$14,125
Discount factor (22%) (b)	1.000	0.820	0.672	0.551	0.451	0.370	0.303
Present value (a)×(b)	$(18,600)	$4,100	$3,360	$2,755	$2,255	$1,850	$4,280
Net present value	$0						

Exercise 15-3

The equipment's net present value without considering the intangible benefits would be:

Item	*Year(s)*	*Amount of Cash Flows*	*20% Factor*	*Present Value of Cash Flows*
Cost of the equipment	Now	$(2,500,000)	1.000	$(2,500,000)
Annual cost savings	1-15	$400,000	4.675	1,870,000
Net present value				$ (630,000)

The annual value of the intangible benefits would have to be great enough to offset a $630,000 negative present value for the equipment. This annual value can be computed as follows:

$$\frac{\text{Required increase in present value}}{\text{Factor for 15 years}} = \frac{\$630{,}000}{4.675} = \$134{,}759$$

Exercise 15-4

1. The project profitability index for each proposal is:

Proposal Number	*Net Present Value* (*a*)	*Investment Required* (*b*)	*Project Profitability Index* (*a*) ÷ (*b*)
A	$36,000	$90,000	0.40
B	$38,000	$100,000	0.38
C	$35,000	$70,000	0.50
D	$40,000	$120,000	0.33

2. The ranking is:

Proposal Number	*Project Profitability Index*
C	0.50
A	0.40
B	0.38
D	0.33

Note that proposal D has the highest net present value, but it ranks lowest in terms of the project profitability index.

Problem 15-11

1. The project profitability index is computed as follows:

Project	*Net Present Value* (*a*)	*Investment Required* (*b*)	*Project Profitability Index* (*a*) ÷ (*b*)
A.....	$44,323	$160,000	0.28
B.....	$42,000	$135,000	0.31
C.....	$35,035	$100,000	0.35
D	$38,136	$175,000	0.22

2. a., b., and c.

	Net Present Value	*Project Profitability Index*	*Internal Rate of Return*
First preference	A	C	D
Second preference.....	B	B	C

Third preference.....	D	A	A
Fourth preference.....	C	D	B

3. Oxford Company's opportunities for reinvesting funds as they are released from a project will determine which ranking is best. The internal rate of return method assumes that any released funds are reinvested at the rate of return shown for a project. This means that funds released from project D would have to be reinvested in another project yielding a rate of return of 22%. Another project yielding such a high rate of return might be difficult to find.

   The project profitability index approach also assumes that funds released from a project are reinvested in other projects. But the assumption is that the return earned by these other projects is equal to the discount rate, which in this case is only 10%. On balance, the project profitability index is generally regarded as being the most dependable method of ranking competing projects.

   The net present value is inferior to the project profitability index as a ranking device, because it looks only at the total amount of net present value from a project and does not consider the amount of investment required. For example, it ranks project C as fourth because of its low net present value; yet this project is the best available in terms of the net present value generated for each dollar of investment (as shown by the project profitability index).

Problem 15-23

1. The payback periods for Products A and B are calculated using a two-step process. First, the annual net cash inflows are calculated as follows:

	Product A	Product B
Sales revenues	$250,000	$350,000
Variable expenses.....	(120,000)	(170,000)
Fixed out-of-pocket operating costs	(70,000)	(50,000)
Annual net cash inflows.....	$ 60,000	$130,000

   The second step is to compute each product's payback period as follows:

	Product A	Product B
Investment required (a)	$170,000	$380,000
Annual net cash inflow (b)	$60,000	$130,000
Payback period (a) ÷ (b)	2.83 years	2.92 years

Problem 15-23 (continued)

2. The net present values for Products A and B are computed as follows:

Product A:

	Now	1	2	3	4	5
Purchase of equipment	$(170,000)					
Sales		$250,000	$250,000	$250,000	$250,000	$250,000
Variable expenses		(120,000)	(120,000)	(120,000)	(120,000)	(120,000)
Fixed out-of-pocket costs		(70,000)	(70,000)	(70,000)	(70,000)	(70,000)
Total cash flows (a)	$(170,000)	$60,000	$60,000	$60,000	$60,000	$60,000
Discount factor (b)	1.000	0.862	0.743	0.641	0.552	0.476
Present value (a)×(b)	$(170,000)	$51,720	$44,580	$38,460	$33,120	$28,560
Net present value	$26,440					

Product B:

	Now	1	2	3	4	5
Purchase of equipment	$(380,000)					
Sales		$350,000	$350,000	$350,000	$350,000	$350,000
Variable expenses		(170,000)	(170,000)	(170,000)	(170,000)	(170,000)
Fixed out-of-pocket costs		(50,000)	(50,000)	(50,000)	(50,000)	(50,000)
Total cash flows (a)	$(380,000)	$130,000	$130,000	$130,000	$130,000	$130,000
Discount factor (b)	1.000	0.862	0.743	0.641	0.552	0.476
Present value (a)×(b)	$(380,000)	$112,060	$96,590	$83,330	$71,760	$61,880
Net present value	$45,620					

3. The internal rate of return for each product is calculated as follows:

	Product A	Product B
Investment required (a)	$170,000	$380,000
Annual net cash inflow (b)	$60,000	$130,000
Factor of the internal rate of return (a) ÷ (b)	2.833	2.923

Looking in Exhibit 15B-2 and scanning along the 5-period line, a factor of 2.833 falls right between 22% and 23%, so we'll estimate an internal rate of return for Product A of 22.5%. A factor of 2.923 is closest to 21%, so we'll estimate an internal rate of return for Product B of 21%.

Problem 15-23 (continued)

4. The project profitability index for each product is computed as follows:

	Product A	Product B
Net present value (a)	$26,440	$45,620
Investment required (b)	$170,000	$380,000
Project profitability index (a) ÷ (b)	0.16	0.12

5. The simple rate of return for each product is computed as follows:

	Product A	Product B
Annual net cash inflow	$60,000	$130,000
Depreciation expense	34,000	76,000
Annual incremental net operating income	$26,000	$54,000

	Product A	Product B
Annual incremental net operating income (a)	$26,000	$54,000
Initial investment (b)	$170,000	$380,000
Simple rate of return (a) ÷ (b)	15.3%	14.2%

6. The net present value calculations suggest that Product B is preferable to Product A. However, the project profitability index reveals that Product A is the preferred choice. The payback period, internal rate of return, and simple rate of return all favor Product A over Product B. However, it bears emphasizing that Lou Barlow may be inclined to reject both products because the simple rate of return for each product is lower than his division's historical return on investment of 18%.

Appendix 15C Net Present Value Analysis
Exercise 15C-1

The project's net present value is computed as follows:

	Now	1	2	3	4	5
Purchase of equipment...	$(2,000,000)					
Sales		$2,800,000	$2,800,000	$2,800,000	$2,800,000	$2,800,000
Variable expenses		(1,600,000)	(1,600,000)	(1,600,000)	(1,600,000)	(1,600,000)
Out-of-pocket costs		(500,000)	(500,000)	(500,000)	(500,000)	(500,000)
Income tax expense ($300,000 × 30%)		(90,000)	(90,000)	(90,000)	(90,000)	(90,000)
Total cash flows (a).....	$(2,000,000)	$610,000	$610,000	$610,000	$610,000	$610,000
Discount factor (b).....	1.000	0.885	0.783	0.693	0.613	0.543
Present value (a)×(b).....	$(2,000,000)	$539,850	$477,630	$422,730	$373,930	$331,230
Net present value.....	$145,370					

Note: The present value of the net cash inflows from years 1 through 5 can also be computed using the appropriate discount factor from Exhibit 15B-2 in Appendix 15B ($610,000 × 3.517 = $2,145,370)