EXERCISE 3-1 (20 minutes)

1. B E point in units = \( \frac{\text{Fixed costs}}{\text{Contribution margin per unit}} \)
   
   \( \frac{\$180,000}{\$40 - \$16} = \frac{\$180,000}{\$24} = 7,500 \text{ units} \)

   B E point in sales dollars = \( \frac{\text{Fixed costs}}{\text{Contribution margin ratio}} \)
   
   \( \frac{\$180,000}{\frac{\text{CM}}{\text{Selling Price}}} = \frac{\$180,000}{\frac{\$24}{\$40}} = \frac{\$180,000}{0.6} = \$300,000 \)
2. At the break-even point, CM = fixed costs. Accordingly, the total CM is $180,000.

3. Total CM = CM per unit x Units sold
   = $24 x 12,000 units = $288,000

   Operating income = Total CM - Fixed costs
   = $288,000 - $180,000 = $108,000

EXERCISE 3-1 (Continued)

4. Target sales in units = \( \frac{\text{Fixed costs} + \text{Target income}}{\text{Contribution margin per unit}} \)
   
   = \( \frac{$180,000 + $60,000}{\$24} \)
   
   = $108,000
= 10,000 units

5.

**Contribution Income Statement**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales ($40 x 10,000 units)</td>
<td>$ 400,000</td>
<td>100%</td>
</tr>
<tr>
<td>Variable costs ($16 x 10,000 units)</td>
<td>160,000</td>
<td>40%</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>240,000</td>
<td>60%</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>180,000</td>
<td></td>
</tr>
<tr>
<td>Operating income</td>
<td><strong>$60,000</strong></td>
<td></td>
</tr>
</tbody>
</table>
EXERCISE 3-2 (10 minutes)

1. The decrease in the sales units mentioned here is called margin of safety (MS) in units.  
   $\text{MS in units} = \text{Units sold} - \text{BE point in units}$  
   $= 12,000 - 7,500 = 4,500 \text{ units}$

2. MS in dollars  
   $= \text{Total sales} - \text{BE point in dollars}$  
   $= $480,000 - $300,000 = $180,000$

   $\text{MS in percentage} = \frac{4,500 \text{ units}}{12,000 \text{ units}} \div \text{or}$  
   $= \frac{$180,000}{\$480,000} = 37.5\%$

3. Yes. The sales decrease of $150,000 is still less than the MS of $180,000. Until the sales decreases by additional $30,000 ($180,000 - $150,000), the company would still make a profit.

4. Yes. The sales decrease of 30% is still below the MS of 37.5%. Accordingly, the company would still make a profit until there is an additional sales decrease of 7.5% (37.5% - 30%).
EXERCISE 3-3 (20 minutes)

1. 
   Degree of operating leverage = \[
   \frac{\text{Total CM}}{\text{Operating income}} = \frac{288,000}{108,000} = 2.6667
   \]

2. If sales increase 10% and the degree of operating leverage is 2.6667, then the following effects will take place:
   
   % Increase in operating income = % Increase in sales x 2.6667
   = 10% x 2.6667 = 26.667%
   
   New operating income
   = $108,000 x (1 + 0.26667)
   = $108,000 + $28,800 = $136,800

3. 
   Contribution Income Statement

   Sales ($40 x 12,000 x 1.1) ...................... $528,000 100%
   Variable costs ($16 x 13,200 units) .....  211,200 40%
   Contribution margin ..........................  316,800 60%
   Fixed costs ..................................  180,000
   Operating income .............................  $136,800
4. If sales decrease 20% and the degree of operating leverage is 2.6667, then the following effects will take place:

   % Decrease in operating income = % Decrease in sales x 2.6667  
   = 20% x 2.6667 = 53.334%  
   New operating income = $108,000 x (1 - 0.53334)  
   = $108,000 - $57,600 = $50,400

5. Contribution Income Statement

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales ($40 x 12,000 x 0.8)</td>
<td>$384,000</td>
<td>100%</td>
</tr>
<tr>
<td>Variable costs ($16 x 9,600 units)</td>
<td>153,000</td>
<td>40%</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>230,000</td>
<td>60%</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>180,000</td>
<td></td>
</tr>
<tr>
<td>Operating income</td>
<td>$50,400</td>
<td></td>
</tr>
</tbody>
</table>
PROBLEM 3-11 (25 minutes)

1. a. Variable costs per unit:
   Selling price ........................................ $ 30
   Variable cost ratio: 1 - CM ratio = 100% - 40% = \times 60%
   Variable costs per unit ................................ $ 18

b. Break-even point (Equation method):
   Sales = VC + FC
   $30X = $18X + $120,000
   $30X - $18X = $120,000
   $12X = $120,000
   \[ X = 10,000 \text{ units (BE point in units)} \]
   $30X = $300,000 (BE point in sales dollars)

c. Let X = Required volume in units.
   Sales = VC + FC + Target income
   $30X = $18X + $120,000 + $24,000
   $30X - $18X = $144,000
   $12X = $144,000
   \[ X = $144,000 \text{ (}$12 = 12,000 \text{ units} \]

Required sales:
   $30X = $30 \times 12,000 \text{ units} = $360,000
2. a. CM per unit:
   
   Selling price .................................. $12.00

   Variable expenses:
   - Manufacturing and selling .......... $ 8.00
   - Sales commissions ($12 x 5% =) . 0.60  8.60
   - Contribution margin .................... $3.40

   b. Operating income for the year:
   - Total CM ($3.40 x 9,000 units) ............ $ 30,600
   - Fixed costs .................................. 24,000
   - Operating income .......................... $ 6,600

   ✓ 0 = $100,010
PROBLEM 3-11 (Continued)

3. First determine last quarter's income.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units sold</td>
<td>25,000</td>
</tr>
<tr>
<td>Contribution margin per unit</td>
<td>$3</td>
</tr>
<tr>
<td>Total contribution margin</td>
<td>$75,000</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>$60,000</td>
</tr>
<tr>
<td>Operating income</td>
<td>$15,000</td>
</tr>
</tbody>
</table>

Required sales volume this year

\[
\frac{($60,000 + $30,000) + $15,000}{\$3} = 35,000 \text{ units}
\]
PROBLEM 3-13 (50 minutes)

1. Selling price per unit ................……… . $20  100%
   VC per unit .................................  $8  40%
   CM per unit .................................  $12  60%

   Fixed costs
   B E point in units = \( \frac{\text{Fixed costs}}{\text{Contribution margin per unit}} \)
   $69,000
   = \( \frac{69,000}{12} \) = 5,750 units

   Fixed costs
   B E point in sales dollars = \( \frac{\text{Fixed costs}}{\text{Contribution margin ratio}} \)
   $69,000
   = \( \frac{69,000}{0.6} \) = $115,000

2. Total CM ($12 x 9,000) .......................... $108,000
   Fixed costs ..................................  $69,000
   Operating income ..........................  $39,000
3.a. Selling price per unit ....................... $ 20 100%

   New VC per unit:
     Existing VC .......................... $8
     Sales commission ($20 x 5%) ...... 1 9 45%
     CM per unit .......................... $11 55%

New fixed costs per quarter:
   Rent ................................ $15,000
   Salaries ............................. 30,000
   Advertising, etc. .................. 10,000
   Total fixed costs ................. $55,000

PROBLEM 3-13 (Continued)

\[
\text{B E point in units} = \frac{\text{Fixed costs}}{\text{Contribution margin per unit}}
\]

\[
= \frac{$55,000}{$11} = 5,000 \text{ units}
\]

b. We will determine whether the new policy generates an operating income of more than $39,000, the operating income in (2).
Total CM ($11 x 9,000) ......................... $99,000
Fixed costs ........................................ 55,000
Operating income ................................. $44,000

The new income, $44,000, is higher than the original level of $39,000. Therefore, the answer is yes.

4. a. At the required sales level (point of indifference), the profit under each policy would be equal.

Sales - Total costs = Profit

Sales would be the same under both policies. Accordingly, we must find the sales level at which the total costs under each policy would be equal.

Let X = Required sales volume in units.

Then,

$8X + $69,000 = $9X + $55,000
$69,000 - $55,000 = $9X - $8X
X = 14,000 units
b. If 14,000 units are sold, the company would make the same profit under each plan as shown below:

Original policy:

Total CM ($12 x 14,000 units) .................. $168,000
Fixed costs ........................................ 69,000
Operating income ............................... $ 99,000

Incentive policy:

Total CM ($11 x 14,000 units) .................. $154,000
Fixed costs ........................................ 55,000
Operating income ............................... $ 99,000

The company would be "indifferent" as to which policy is used.

5. Incremental approach:

Break-even sales .......................5,000 units  $ 0
Excess over break-even sales ..... 1,500
CM $11 - Extra ($20 x 5%) = x $10  15,000
Total profit .................................................. $ 15,000

Note: CM = Profit (for sales in excess of BE point)

Total approach:
Sales ($20 \times 6,500 \text{ units}) ......................... $ 130,000
Variable costs:
\hspace{1cm} $9 \times 5,000 \text{ units} = \hspace{1cm} $ 45,000
\hspace{1cm} $10 \times 1,500 \text{ units} = \hspace{1cm} 15,000 \hspace{1cm} 60,000
Contribution margin ................................. 70,000
Fixed costs ............................................. 55,000
Operating income ................................. $ 15,000