EXERCISES

Ex. 19–1 (FIN MAN); Ex. 4–1 (MAN)

1. Fixed
2. Fixed
3. Variable
4. Fixed
5. Variable
6. Variable
7. Variable
8. Variable
9. Variable
10. Mixed
11. Mixed
12. Fixed
13. Variable
14. Variable
15. Variable

Ex. 19–2 (FIN MAN); Ex. 4–2 (MAN)

a. Cost Graph One
b. Cost Graph Four
c. Cost Graph Two
d. Cost Graph Three
e. Cost Graph Three

Ex. 19–3 (FIN MAN); Ex. 4–3 (MAN)

1. d
2. a
3. a
4. b
5. e
6. c

Ex. 19–4 (FIN MAN); Ex. 4–4 (MAN)

1. g
2. c
3. h

(h) is better than (a) because the administrative costs would be the same for expensive and inexpensive cars.
Ex. 19–5 (FIN MAN); Ex. 4–5 (MAN)

a. Fixed
b. Variable
c. Variable
d. Variable
e. Fixed
f. Variable
g. Fixed
h. Fixed
i. Variable
j. Variable
k. Variable
l. Fixed*

*The developer salaries are fixed because they are more variable to the number of titles or releases, rather than the number of units sold. For example, a title could sell one copy or a million copies, and the salaries of the developers would not be affected.

Ex. 19–6 (FIN MAN); Ex. 4–6 (MAN)

<table>
<thead>
<tr>
<th>Components produced...</th>
<th>300,000</th>
<th>360,000</th>
<th>375,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total costs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total variable costs ...</td>
<td>$75,000</td>
<td>(d) $90,000</td>
<td>(j) $93,750</td>
</tr>
<tr>
<td>Total fixed costs .......</td>
<td>90,000</td>
<td>(e) 90,000</td>
<td>(k) 90,000</td>
</tr>
<tr>
<td>Total costs ..............</td>
<td>$165,000</td>
<td>(f) $180,000</td>
<td>(l) $183,750</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost per unit:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable cost per unit</td>
<td>$0.25</td>
<td>(g) $0.25</td>
<td>(m) $0.25</td>
</tr>
<tr>
<td>Fixed cost per unit.....</td>
<td>0.30</td>
<td>(h) 0.25</td>
<td>(n) 0.24</td>
</tr>
<tr>
<td>Total cost per unit.....</td>
<td>$0.55</td>
<td>(i) $0.50</td>
<td>(o) $0.49</td>
</tr>
</tbody>
</table>

Supporting calculations:

a. $0.25 ($75,000/300,000 units)
b. $0.30 ($90,000/300,000 units)
d. $90,000 ($0.25 × 360,000)
e. $90,000 (fixed costs do not change with volume)
g. $0.25 ($90,000/360,000 units; variable costs per unit do not change with changes in volume)
h. $0.25 ($90,000/360,000 units)
j. $93,750 ($0.25 × 375,000 units)
k. $90,000 (fixed costs do not change with volume)
m. $0.25 ($93,750/375,000 units; variable costs per unit do not change with changes in volume)
n. $0.24 ($90,000/375,000 units)
Ex. 19–7 (FIN MAN); Ex. 4–7 (MAN)

a. Variable Cost per Unit = \( \frac{\text{Difference in Total Costs}}{\text{Difference in Production}} \)

Variable Cost per Unit = \( \frac{\$920,000 - \$700,000}{22,500 \text{ units} - 10,000 \text{ units}} \)

Variable Cost per Unit = \( \frac{\$220,000}{12,500 \text{ units}} = \$17.60 \text{ per unit} \)

The fixed cost can be determined by subtracting the estimated total variable cost from the total cost at either the highest or lowest level of production, as follows:

Total Cost = (Variable Cost per Unit \times \text{Units of Production}) + \text{Fixed Cost}

Highest level:

\$920,000 = (\$17.60 \times 22,500 \text{ units}) + \text{Fixed Cost}
\$920,000 = \$396,000 + \text{Fixed Cost}
\$524,000 = \text{Fixed Cost}

Lowest level:

\$700,000 = (\$17.60 \times 10,000 \text{ units}) + \text{Fixed Cost}
\$700,000 = \$176,000 + \text{Fixed Cost}
\$524,000 = \text{Fixed Cost}

b. Total Cost = (Variable Cost per Unit \times \text{Units of Production}) + \text{Fixed Cost}

Total cost for 14,000 units:

Variable cost:

<table>
<thead>
<tr>
<th>Units</th>
<th>Variable cost per unit</th>
<th>Total variable cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>14,000</td>
<td>( \times $17.60 )</td>
<td>$246,400</td>
</tr>
</tbody>
</table>

Fixed cost \( \$524,000 \)

Total cost \( \$770,400 \)
Ex. 19–8 (FIN MAN); Ex. 4–8 (MAN)

Variable Cost per Gross-Ton Mile = \frac{\text{Difference in Total Costs}}{\text{Difference in Gross-Ton Miles}}

= \frac{\$1,250,000 - \$900,000}{525,000 \text{ gross-ton miles} - 350,000 \text{ gross-ton miles}}

= \frac{\$350,000}{175,000 \text{ gross-ton miles}} = \$2.00 \text{ per gross-ton mile}

The fixed cost can be determined by subtracting the estimated total variable cost from the total cost at either the highest or lowest level of gross-ton miles, as follows:

Total Cost = (Variable Cost per Gross-Ton Mile × Gross-Ton Miles) + Fixed Cost

Highest level:
$1,250,000 = ($2.00 × 525,000 gross-ton miles) + Fixed Cost
$1,250,000 = $1,050,000 + Fixed Cost
$200,000 = Fixed Cost

Lowest level:
$900,000 = ($2.00 × 350,000 gross-ton miles) + Fixed Cost
$900,000 = $700,000 + Fixed Cost
$200,000 = Fixed Cost

Ex. 19–9 (FIN MAN); Ex. 4–9 (MAN)

a. Sales ......................... $1,800,000
Variable costs .................. 1,080,000
Contribution margin ......... $ 720,000

Contribution Margin Ratio = \frac{\text{Sales} - \text{Variable Costs}}{\text{Sales}}

= \frac{\$720,000}{\$1,800,000} = 40\%

b. Sales ......................... $900,000
Contribution margin ratio ... × 32\%
Contribution margin ........... $288,000
Less fixed costs .............. 210,000
Income from operations...... $ 78,000
Ex. 19–10 (FIN MAN); Ex. 4–10 (MAN)

a. Sales ................................................................. $16,561
   Variable costs:
   Food and packaging ........................................ $ 5,586
   Payroll ......................................................... 4,300
   General, selling, and administrative expenses (40% × $2,355) 942
   Total variable costs ........................................ $10,828
   Contribution margin ......................................... $ 5,733

b. Contribution Margin Ratio = \( \frac{\text{Sales} - \text{Variable Costs}}{\text{Sales}} \)
   Contribution Margin Ratio = \( \frac{5,733}{16,561} \) = 34.6%

c. Same-store sales increase ....................... $400,000,000
   Contribution margin ratio [from part (b)] ............ \( \times 34.6\% \)
   Increase in income from operations ................ $138,400,000

   Note to Instructors: Part (c) emphasizes “same-store sales” because of the assumption of no change in fixed costs. McDonald’s will also increase sales from opening new stores. However, the impact on income from operations for these additional sales would need to include an increase in fixed costs into the calculation.

Ex. 19–11 (FIN MAN); Ex. 4–11 (MAN)

a. Break-Even Sales (units) = \( \frac{\text{Fixed Costs}}{\text{Unit Contribution Margin}} \)
   Break-Even Sales (units) = \( \frac{740,000}{80 - 55} \) = 29,600 units

b. Sales (units) = \( \frac{\text{Fixed Costs} + \text{Target Profit}}{\text{Unit Contribution Margin}} \)
   Sales (units) = \( \frac{740,000 + 140,000}{80 - 55} \) = 35,200 units
Ex. 19–12 (FIN MAN); Ex. 4–12 (MAN)

a. Break-Even Sales (units) = \( \frac{\text{Fixed Costs}}{\text{Unit Contribution Margin}} \)

Break-Even Sales (units) = \( \frac{\$7,282,600,000}{\$117.54 - \$38.76 - \$15.66} = 115,377,060 \text{ barrels} \)

The variable costs per unit are determined by multiplying the total amount of each cost by the variable cost percentage (75% for production costs and 40% for marketing and distribution costs), then dividing by the number of barrels.

\[
\begin{align*}
1 & \text{ ($10,336,000,000 \times 25\%) + ($7,831,000,000 \times 60\%) } \\
2 & \text{ $23,507,000,000/200,000,000} \\
3 & \text{ ($10,336,000,000 \times 75\%)/200,000,000} \\
4 & \text{ ($7,831,000,000 \times 40\%)/200,000,000} \\
\end{align*}
\]

b. Break-Even Sales (units) = \( \frac{\$7,282,600,000 + \$225,000,000}{\$117.54 - \$38.76 - \$15.66} = 118,941,698 \text{ barrels} \)

Ex. 19–13 (FIN MAN); Ex. 4–13 (MAN)

a. Break-Even Sales (units) = \( \frac{\text{Fixed Costs}}{\text{Unit Contribution Margin}} \)

Break-Even Sales (units) = \( \frac{\$345,000}{\$110 - \$80} = 11,500 \text{ units} \)

b. Break-Even Sales (units) = \( \frac{\text{Fixed Costs}}{\text{Unit Contribution Margin}} \)

Break-Even Sales (units) = \( \frac{\$345,000}{\$120 - \$80} = 8,625 \text{ units} \)
Ex. 19–14 (FIN MAN); Ex. 4–14 (MAN)

Break-Even Sales (units) = \( \frac{\text{Fixed Costs}}{\text{Unit Contribution Margin}} \)

Break-Even Sales (units) = \( \frac{\$25,000}{\$15 - \$X} \) = 5,000 units

Variable cost per unit: \( \$25,000 = 5,000 \times (\$15 - \$X) \)

Variable cost per unit: \( \frac{\$25,000}{5,000} = \$15 - \$X \)

Variable cost per unit: \$5.00 = \$15 - \$X

Variable cost per unit: \$10.00

Ex. 19–15 (FIN MAN); Ex. 4–15 (MAN)

The cost of the promotional campaign is the fixed cost in this analysis, since we're trying to determine the break-even adoption rate of the campaign.

The contribution margin earned per new subscriber is essentially the revenue earned less the variable cost over the 23-month subscription period.

Revenue: \((23 \text{ mos.} - 2 \text{ free mos.}) \times \$15/\text{mo.} = \$315\) per new account

Variable cost: \(23 \text{ mos.} \times \$5.00/\text{mo.} = \$115\) per new account

Note: The variable cost is for 23 months since the costs are incurred, even for the free months.

The break-even number of subscribers necessary to cover the fixed cost of the promotion would be computed as follows:

\[
\text{Break-Even} = \frac{\text{Fixed Cost}}{\text{Contribution Margin per Unit}}
\]

\[
\text{Break-Even} = \frac{\$3,150,000}{\$315 - \$115 \text{ per account}} = 15,750 \text{ accounts}
\]

Therefore, if ESPN.com yielded more than 15,750 new subscribers out of the promotional campaign, the costs of the campaign would be covered.
Ex. 19–16 (FIN MAN); Ex. 4–16 (MAN)

a. Break-Even = \[
\frac{\text{Fixed Cost}}{\text{Revenue per Account} – \text{Variable Cost per Account}}
\]

Break-Even = \[
\frac{17,250.7^3}{971.0^1 - 457.9^2}
\]

Break-Even = 33.6 million (rounded) accounts

1Revenue per account (in millions):

\[
\frac{35,635}{36.7} = 971.0 \text{ (rounded)}
\]

2Variable cost per account (in millions):

- Cost of revenue .......................................... \(16,746 \times 80\% = 13,396.8\)
- Selling, general, and administrative expenses ........................................... \(11,355 \times 30\% = 3,406.5\)
- Total variable cost ...................................... \(16,803.3\)
- Divided by number of accounts ................... \(\div 36.7\)
- Variable cost per account (rounded)....... \(\$ 457.9\)

3Fixed costs (in millions):

- Cost of revenue .......................................... \(16,746 \times 20\% = 3,349.2\)
- Selling, general, and administrative expenses ........................................... \(11,355 \times 70\% = 7,948.5\)
- Depreciation ............................................... \(5,953 \times 100\% = 5,953.0\)
- Total fixed costs ......................................... \(17,250.7\)

b. Break-Even = \[
\frac{\text{Fixed Cost}}{\text{Revenue per Account} – \text{Variable Cost per Account}}
\]

\[
36.7 \text{ accounts} = \frac{17,250.7}{X} - 457.9
\]

\[
36.7X - 16,804.9 = 17,250.7
\]

\[
36.7X = 34,055.6
\]

\[
X = 928.0 \text{ (rounded)}
\]

Note to Instructors: The rate charged per minute and the number of average minutes of digital service influence the revenue per account. An interesting question is whether the costs are variable to the number of minutes or number of accounts. If we assume that the costs are variable to the number of minutes, then the break-even analysis revolves around the number of minutes. More likely, the costs are more variable to the number of accounts for this business (mostly customer acquisition and service costs), while the variable cost per minute is likely to be small.
Ex. 19–17 (FIN MAN); Ex. 4–17 (MAN)

a. 

b. $720,000 (the intersection of the total sales line and the total costs line)

c. The graphic format permits the user (management) to visually determine the break-even point and the operating profit or loss for any given level of sales.
Ex. 19–18 (FIN MAN); Ex. 4–18 (MAN)

a. $240,000 (total fixed costs)

b. Sales (10,000 units × $120) ...................................... $1,200,000

   Fixed costs ......................................................... $240,000
   Variable costs (10,000 units × $80) .................. 800,000
   Income from operations ................................. $ 160,000

   1,040,000

c. 6,000 units (the intersection of the profit line and the horizontal axis)

d. Ex. 19–19 (FIN MAN); Ex. 4–19 (MAN)

Cost-volume-profit chart

a. operating loss area  
d. break-even point
b. fixed costs  
e. total sales
c. total costs  
f. operating profit area

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Ex. 19–20 (FIN MAN); Ex. 4–20 (MAN)

Profit-volume chart
a. maximum income from operations
b. operating loss area
c. fixed costs
d. profit line
e. break-even line
f. operating profit area

Ex. 19–21 (FIN MAN); Ex. 4–21 (MAN)

a. Unit Selling Price of E = ($100.00 × 0.60) + ($80 × 0.40)
   Unit Selling Price of E = $60.00 + $32.00 = $92.00
   Unit Variable Cost of E = ($75.00 × 0.60) + ($60.00 × 0.40)
   Unit Variable Cost of E = $45.00 + $24.00 = $69.00
   Unit Contribution Margin of E = $92.00 – $69.00 = $23.00

   Break-Even Sales (units) = \frac{Fixed Costs}{Unit Contribution Margin}

   Break-Even Sales (units) = \frac{$460,000}{$23.00} = 20,000 units

b. 12,000 units of baseball bats (20,000 units × 0.60)
   8,000 units of baseball gloves (20,000 units × 0.40)
Ex. 19–22 (FIN MAN); Ex. 4–22 (MAN)

a. Unit contribution margin of overall product (E):

- Unit selling price of E \([(10\% \times $600) + (90\% \times $190)]\) .....................  $231.00
- Unit variable cost of E \([(10\% \times $100) + (90\% \times $75)]\) ...................... 77.50
- Unit contribution margin of E ...........................................................  $153.50

Fixed costs of the Philadelphia to Orlando round-trip flight:
- Fuel .......................................  $ 8,200
- Flight crew salaries .............  3,700
- Depreciation .........................  3,450
- Total fixed costs .................. $15,350

Break-even in sales (units) of overall product:

\[
\text{Break-Even Sales (units)} = \frac{\text{Fixed Costs}}{\text{Unit Contribution Margin}}
\]

\[
\text{Break-Even Sales (units)} = \frac{$15,350}{\$153.50 \text{ per seat}} = 100 \text{ seats (tickets)}
\]

b. Business class break-even (100 seats \(\times 10\%\))............ 10 seats
Economy class break-even (100 seats \(\times 90\%\))............ 90 seats
Total break-even .................................................................. 100 seats

Ex. 19–23 (FIN MAN); Ex. 4–23 (MAN)

a. (1) \(\$162,000 \text{ ($540,000} – \$378,000)\)
(2) \(30\% \text{ ($162,000}/\$540,000)\)

b. The break-even point (S) is determined as follows:

\[\text{Sales} = \$900,000 + 70\% \text{ Sales}\]
\[\text{Sales} – 70\% \text{ Sales} = \$900,000\]
\[30\% \text{ Sales} = \$900,000\]
\[\text{Sales} = \$3,000,000\]

If the margin of safety is 20%, the sales are determined as follows:

\[\text{Sales} = \$3,000,000 + 20\% \text{ Sales}\]
\[\text{Sales} – 20\% \text{ Sales} = \$3,000,000\]
\[80\% \text{ Sales} = \$3,000,000\]
\[\text{Sales} = \$3,750,000\]
Ex. 19–24 (FIN MAN); Ex. 4–24 (MAN)

If 200,000 units are sold and sales at the break-even point are 225,000 units, there is no margin of safety.

Ex. 19–25 (FIN MAN); Ex. 4–25 (MAN)

a. Fulp Inc.:

Operating Leverage = \frac{\text{Contribution Margin}}{\text{Income from Operations}}

\[
\text{Operating Leverage} = \frac{1,600,000}{400,000} = 4.00
\]

Baucom Inc.:

Operating Leverage = \frac{\text{Contribution Margin}}{\text{Income from Operations}}

\[
\text{Operating Leverage} = \frac{1,000,000}{400,000} = 2.50
\]

b. Fulp Inc.’s income from operations would increase by 100% (4.00 × 25%), or $400,000 (100% × $400,000), and Baucom Inc.’s income from operations would increase by 62.5% (2.50 × 25%), or $250,000 (62.5% × $400,000).

c. The difference in the increases of income from operations is due to the difference in the operating leverages. Fulp Inc.’s higher operating leverage means that its fixed costs are a larger percentage of contribution margin than are Baucom Inc.’s. Thus, increases in sales increase operating profit at a faster rate for Fulp than for Baucom.