Cash flow provided by operating activities **(3.1)**

$$\begin{aligned}&= \text{Net earnings} + \text{depreciation and amortization}\\&+ \text{cash from (used in) other income statement adjustments}\\&+ \text{cash from (used in) non-cash working capital}\\&= \$102.2 \text{ million} + \$125.5 \text{ million} - \$29.5 \text{ million} + \$41 \text{ million}\\&= \$239.2 \text{ million}\end{aligned}$$

Cash flow from assets $= \text{cash flow provided by operating activities}$ **(3.2)**

$$\begin{aligned}&+ \text{cash flow from (used in) investments}\\&= \$239.2 \text{ million} - \$543.2 \text{ million} = -\$304 \text{ million}\end{aligned}$$

Increase (decrease) in cash in the bank **(3.3)**

$$\begin{aligned}&= \text{Cash flow from assets} + \text{Cash flow from (used in) financing activities}\\&= -\$304 \text{ million} + \$376.9 \text{ million} = \$72.9 \text{ million}\end{aligned}$$

Cash flow from assets $= \text{Cash flow used in (from) financing activities} + \text{Increase (decrease) in cash in the bank}$ **(3.4)**

Cash flow from assets (adjusted) $= \text{Cash flow from assets} + \text{interest expense}$ **(3.5)**

$$= -\$304 \text{ million} + \$83.5 \text{ million} = -\$220.5$$

$$\text{FV of } \$I \text{ investment} = I \times (1 + r)^t \qquad (4.1)$$

$$\text{Future value factor, FVIF}(r,t) = (1 + r)^t \qquad (4.2)$$

$$\text{FV} = I \times \text{future value factor} = I \times \text{FVIF}(r,t) = I \times (1 + r)^t \qquad (4.3)$$

$$\text{Present value} = \frac{\text{future value after } t \text{ periods}}{(1 + r)^t} \qquad (4.4)$$

$$\begin{aligned}\text{PV} &= \frac{\text{future payment}}{(1 + r)^t}\\&= \text{future payment} \times \frac{1}{(1 + r)^t}\end{aligned} \qquad (4.5)$$

$$\text{PV} = I \times \text{discount factor} = I \times \text{PVIF}(r,t) = I \times \frac{1}{(1 + r)^t} \qquad (4.6)$$

$$\text{PV of perpetuity} = \frac{C}{r} = \frac{\text{cash payment}}{\text{interest rate}} \qquad (4.7)$$

$$\text{Present value of } t\text{-year annuity} = C \times \left[\frac{1}{r} - \frac{1}{r(1 + r)^t}\right] \qquad (4.8)$$

$$\text{Present value of } t\text{-year annuity} = \text{payment} \times \text{annuity factor} = C \times \text{PVA}(r,t) \qquad (4.9)$$

$$\text{PV annuity due} = 1 + \text{PV ordinary annuity of } t - 1 \text{ payments}$$
$$= 1 + \left[\frac{1}{r} - \frac{1}{r\,(1+r)^{t-1}} \right] \qquad (4.10)$$

$$\begin{array}{l}\text{Future value of annuity} \\ \text{of \$1 per year, FVA } (r,t)\end{array} = \text{present value of annuity of \$1 per year} \times (1+r)^t$$

$$\text{FVA }(r,t) = \left[\frac{1}{r} - \frac{1}{r(1+r)^t} \right] \times (1+r)^t \qquad (4.11)$$
$$\text{FVA }(r,t) = \frac{(1+r)^t - 1}{r}$$

$$\text{Present value of a perpetual stream of payments growing at a constant rate} = \frac{C_1}{r - g} \qquad (4.12)$$

$$\begin{array}{l}\text{Present value of a finite stream of} \\ \text{payments growing at a constant rate}\end{array} = \frac{C_1}{r-g}\left(1 - \left[\frac{1+g}{1+r}\right]^t\right) \qquad (4.13)$$

$$1 + \text{real interest rate} = \frac{1 + \text{nominal interest rate}}{1 + \text{inflation rate}} \qquad (4.14)$$

$$\text{Real interest rate} \approx \text{nominal interest rate} - \text{inflation rate} \qquad (4.15)$$

$$1 + \text{effective annual rate} = (1 + \text{monthly rate})^{12} \qquad (4.16)$$

$$1 + \text{effective annual rate} = \left(1 + \frac{APR}{m}\right)^m \qquad (4.17)$$

$$\text{Per period interest rate} = \frac{\text{APR}}{m} = (1 + \text{effective annual rate})^{1/m} - 1 \qquad (4.18)$$

$$\text{PV (bond)} = \text{PV (coupons)} + \text{PV (face value)}$$
$$= (\text{coupon} \times \text{annuity factor}) + (\text{face value} \times \text{discount factor}) \qquad (5.1)$$
$$= \$72.50 \times \left[\frac{1}{.036} - \frac{1}{.036(1.036)^3}\right] + 1{,}000 \times \frac{1}{1.036^3}$$
$$= \$202.73 + \$899.33 = \$1{,}102.06$$

$$\text{Rate of return} = \frac{\text{coupon income} + \text{price change}}{\text{investment}} \qquad (5.2)$$

$$1 + \text{nominal interest rate} = (1 + \text{real interest rate}) \times (1 + \text{expected inflation rate}) \qquad (5.3)$$

$$\text{Nominal interest rate} = \text{real interest rate} + \text{expected inflation rate} \qquad (5.4)$$

$$\text{Duration} = 1 \times \frac{\text{PV}(C_1)}{P_0} + 2 \times \frac{\text{PV}(C_2)}{P_0} + 3 \times \frac{\text{PV}(C_3)}{P_0} + \ldots + n \times \frac{\text{PV}(C_n)}{P_0} \qquad (5.\text{A}1)$$

$$\text{Expected return} = r = \frac{DIV_1 + P_1 - P_0}{P_0} \tag{6.1}$$

$$\text{After-tax rate of return} = \frac{Div_1 - \text{dividend tax}}{P_0} + \frac{\text{Capital gain} - \text{capital gains tax}}{P_0} \tag{6.2}$$

$$P_0 = \frac{DIV_1}{1+r} + \frac{DIV_2}{(1+r)^2} + \ldots + \frac{DIV_H + P_H}{(1+r)^H} \tag{6.3}$$

$$\text{Stock price} = \text{PV (all future dividends per share)} \tag{6.4}$$

$$P_0 = \frac{DIV_1}{r} \tag{6.5}$$

$$P_0 = \frac{DIV_1}{r - g} \tag{6.6}$$

$$r = \frac{DIV_1}{P_0} + g = \text{dividend yield} + \text{growth rate} \tag{6.7}$$

$$P_0 = \underbrace{\frac{DIV_1}{1+r} + \frac{DIV_2}{(1+r)^2} + \ldots + \frac{DIV_H}{(1+r)^H}}_{\text{PV of dividends from Year 1 to horizon}} + \underbrace{\frac{P_H}{(1+r)^H}}_{\text{PV of stock price at horizon}} \tag{6.8}$$

$$g = \text{return on equity} \times \text{plowback ratio} = .20 \times .40 = .08, \text{ or 8 percent} \tag{6.9}$$

$$\text{NPV} = \text{PV} - \text{required investment} = \$373{,}832 - \$350{,}000 = \$23{,}832 \tag{7.1}$$

$$\text{Book rate of return} = \frac{\text{book income}}{\text{book assets}} \tag{7.2}$$

$$\text{Equivalent annual cost} = \frac{\text{present value of costs}}{\text{annuity factor}} \tag{7.3}$$

$$\text{Profitability index} = \frac{\text{net present value}}{\text{initial investment}} \tag{7.4}$$

$$\begin{matrix}\text{Incremental}\\ \text{cash flow}\end{matrix} = \begin{matrix}\text{cash flow}\\ \text{with project}\end{matrix} - \begin{matrix}\text{cash flow}\\ \text{without project}\end{matrix} \tag{8.1}$$

$$\begin{aligned}\text{Total cash flow} &= \text{cash flow from investment in plant and equipment}\\ &+ \text{cash flow from investment in working capital}\\ &+ \text{cash flow from operations}\end{aligned} \tag{8.2}$$

$$\text{Depreciation tax shield} = \text{depreciation} \times \text{tax rate} \tag{8.3}$$

$$\text{Taxable income} = \text{revenues} - \text{expenses} - \text{CCA} \tag{8.4}$$

$$\text{CCA tax shield} = \text{CCA} \times \text{tax rate} \tag{8.5}$$

$$\text{Break-even level of revenues} = \frac{\begin{array}{c}\text{fixed costs} \\ \text{including depreciation}\end{array}}{\begin{array}{c}\text{additional profit} \\ \text{from each additional dollar of sales}\end{array}} \tag{9.1}$$

$$\text{Percentage return} = \frac{\text{capital gain} + \text{dividend}}{\text{initial share price}} \tag{10.1}$$

$$\text{Dividend yield} = \frac{\text{dividend}}{\text{initial share price}} \tag{10.2}$$

$$\text{Percentage capital gain} = \frac{\text{capital gain}}{\text{initial share price}} \tag{10.3}$$

$$1 + \text{real rate of return} = \frac{1 + \text{nominal rate of return}}{1 + \text{inflation rate}} \tag{10.4}$$

$$\begin{array}{c}\text{Rate of return} \\ \text{on common stocks}\end{array} = \begin{array}{c}\text{interest rate on} \\ \text{Treasury bills}\end{array} + \begin{array}{c}\text{market risk} \\ \text{premium}\end{array} \tag{10.5}$$

$$\text{Expected return} = \text{probability-weighted average of possible outcomes} \tag{10.6}$$

$$\text{Variance} = \begin{array}{c}\text{probability-weighted average of squared} \\ \text{deviations around the expected return}\end{array} \tag{10.7}$$

$$\text{Standard deviation} = \text{square root of variance} \tag{10.8}$$

$$\text{Variance} = \text{sum of squared deviations}/(\text{number of observations} - 1) \tag{10.9}$$

$$\text{Standard deviation} = \text{square root of variance} \tag{10.10}$$

$$\begin{array}{c}\text{Portfolio rate} \\ \text{of return}\end{array} = \left(\begin{array}{c}\text{fraction of portfolio} \\ \text{in first asset}\end{array} \times \begin{array}{c}\text{rate of return} \\ \text{on first asset}\end{array}\right) + \left(\begin{array}{c}\text{fraction of portfolio} \\ \text{in second asset}\end{array} \times \begin{array}{c}\text{rate of return} \\ \text{on second asset}\end{array}\right) \tag{10.11}$$

$$\text{Correlation between } x \text{ and } y = \frac{\text{Covariance between } x \text{ and } y}{\text{Standard deviation of } x \times \text{Standard deviation of } y} \quad (10.12)$$

$$\text{Portfolio standard deviation} = \sigma_p = \sqrt{x_S^2\sigma_S^2 + x_G^2\sigma_G^2 + 2x_S x_G \rho_{SG}\sigma_S\sigma_G} \quad (10.13)$$

$$\text{Beta of stock j} = \beta_j = \frac{\rho_{j,m}\sigma_j}{\sigma_m} \quad (11.1)$$

$$\text{Beta of stock j} = \beta_j = \frac{\text{cov}(r_j, r_m)}{\sigma_m^2} \quad (11.2)$$

$$\text{Risk premium on any asset} = r - r_f = \beta(r_m - r_f) \quad (11.3)$$

$$\text{Expected return} = \text{risk-free rate} + \text{risk premium} \quad (11.4)$$

Value of business = value of portfolio of all the firm's debt and equity securities (12.1)

Risk of business = risk of portfolio (12.2)

Rate of return on business = rate of return on portfolio (12.3)

Investors' required return on business (company cost of capital) = investors' required return on portfolio (12.4)

Company cost of capital = weighted average of debt and equity returns (12.5)

$$r_{\text{assets}} = \frac{\text{total income}}{\text{value of investment}} \quad (12.6)$$

$$= \frac{(D \times r_{\text{debt}}) + (E \times r_{\text{equity}})}{V} = \left(\frac{D}{V} \times r_{\text{debt}}\right) + \left(\frac{E}{V} \times r_{\text{equity}}\right)$$

$$\text{After-tax cost of debt} = \text{pretax cost} \times (1 - \text{tax rate}) \quad (12.7)$$

$$= r_{\text{debt}} \times (1 - T_c)$$

$$\text{WACC} = \left[\frac{D}{V} \times (1 - T_c)r_{\text{debt}}\right] + \left[\frac{E}{V} \times r_{\text{equity}}\right] \quad (12.8)$$

$$\text{WACC} = \left[\frac{D}{V} \times (1 - T_c)r_{\text{debt}}\right] + \left[\frac{P}{V} \times r_{\text{preferred}}\right] + \left[\frac{E}{V} \times r_{\text{equity}}\right] \quad (12.9)$$

$$r_{\text{preferred}} = \frac{\text{dividend}}{\text{price of preferred}} \tag{12.10}$$

$$\beta_{\text{assets}} = \frac{D}{V} \times \beta_{\text{debt}} + \frac{E}{V} \times \beta_{\text{equity}} \tag{12.11}$$

$$\beta_{\text{equity}} = \beta_{\text{assets}} + (\beta_{\text{assets}} - \beta_{\text{debt}})\frac{D}{E} \tag{12.12}$$

$$\beta_{\text{equity}} = \beta_{\text{assets}} \times \left(1 + \frac{D}{E}\right) \tag{12.13}$$

$$\beta_{\text{levered}} = \beta_{\text{u}} + (\beta_{\text{u}} - \beta_{\text{debt}})(1 - T_C)\frac{D}{E} \tag{12.14}$$

$$\beta_{\text{levered}} = \beta_{\text{u}} \times \left[1 + (1 - T_C) \times \frac{D}{E}\right] \tag{12.15}$$

$$\begin{matrix}\text{Expected}\\ \text{return}\\ \text{on equity}\end{matrix} = \begin{matrix}\text{expected}\\ \text{return}\\ \text{on assets}\end{matrix} + \left[\begin{matrix}\text{debt-}\\ \text{equity}\\ \text{ratio}\end{matrix} \times \left(\begin{matrix}\text{expected}\\ \text{return on}\\ \text{assets}\end{matrix} - \begin{matrix}\text{expected}\\ \text{return on}\\ \text{debt}\end{matrix}\right)\right] \tag{15.1}$$

$$\text{PV tax shields} = \frac{\text{annual tax shield}}{r_{\text{debt}}} = \frac{T_c \times (r_{\text{debt}} \times D)}{r_{\text{debt}}} = T_c D \tag{15.2}$$

$$\text{WACC} = (1 - T_c)\, r_{\text{debt}} \left(\frac{D}{D+E}\right) + r_{\text{equity}} \left(\frac{E}{D+E}\right) \tag{15.3}$$

$$\begin{matrix}\text{Overall market}\\ \text{value}\end{matrix} = \begin{matrix}\text{value if all-equity}\\ \text{financed}\end{matrix} + \begin{matrix}\text{PV tax}\\ \text{shield}\end{matrix} - \begin{matrix}\text{PV costs of}\\ \text{financial distress}\end{matrix} \tag{15.4}$$

$$\text{ROA} = \frac{\text{net income}}{\text{assets}} = \underbrace{\frac{\text{sales}}{\text{assets}}}_{\text{asset turnover}} \times \underbrace{\frac{\text{net income}}{\text{sales}}}_{\text{net profit margin}} \tag{17.1}$$

$$\text{ROE} = \underbrace{\frac{\text{assets}}{\text{equity}}}_{\text{leverage ratio}} \times \underbrace{\frac{\text{sales}}{\text{assets}}}_{\text{asset turnover}} \times \underbrace{\frac{\text{net income}}{\text{sales}}}_{\text{net profit margin}} = \frac{\text{assets}}{\text{equity}} \times \text{ROA} \tag{17.2}$$

$$\text{Residual income} = \text{After-tax operating profit} - \text{cost of capital} \times \text{invested capital} \quad (17.3)$$

$$\text{Residual income} = (\text{ROIC} - \text{cost of capital}) \times \text{invested capital} \quad (17.4)$$

$$\begin{aligned}\text{Required external financing} &= \text{new investment} - \begin{matrix}\text{addition to}\\ \text{retained earnings}\end{matrix} \quad (18.1)\\ &= (\text{growth rate} \times \text{assets}) - \begin{matrix}\text{addition to}\\ \text{retained earnings}\end{matrix}\end{aligned}$$

$$\text{Internal growth rate} = \frac{\text{addition to retained earnings}}{\text{assets}} \quad (18.2)$$

$$\begin{aligned}\text{Internal growth rate} &= \frac{\text{addition to retained earnings}}{\text{net income}} \times \frac{\text{net income}}{\text{equity}} \times \frac{\text{equity}}{\text{assets}} \quad (18.3)\\ &= \text{plowback ratio} \times \text{return on equity} \times \frac{\text{equity}}{\text{assets}}\end{aligned}$$

$$\text{Sustainable growth rate} = \text{plowback ratio} \times \text{return on equity} \quad (18.4)$$

$$\begin{aligned}\text{Cash conversion cycle} &= (\text{inventory period} + \text{receivables period}) \quad (19.1)\\ &- \text{accounts payable period}\end{aligned}$$

$$\text{Inventory period} = \frac{\text{average inventory}}{\text{annual cost of goods sold/365}} \quad (19.2)$$

$$\text{Accounts receivable period} = \frac{\text{average accounts receivable}}{\text{annual sales/365}} \quad (19.3)$$

$$\text{Accounts payable period} = \frac{\text{average accounts payable}}{\text{annual cost of goods sold/365}} \quad (19.4)$$

$$\text{Inventory period} = \begin{matrix}\text{average inventory}\\ \text{annual cost of goods sold/365}\end{matrix} \quad (19.5)$$

$$\text{Receivables period} = \begin{matrix}\text{average accounts receivable}\\ \text{annual sales/365}\end{matrix} \quad (19.6)$$

$$\text{Payables period} = \begin{matrix}\text{average accounts payable}\\ \text{annual cost of goods sold/365}\end{matrix} \quad (19.7)$$

$$\text{Ending accounts receivable} = \text{beginning accounts receivable} + \text{sales} - \text{collections} \tag{19.8}$$

$$\text{Economic order quantity} = \sqrt{\frac{2 \times \text{annual sales} \times \text{cost per order}}{\text{carrying cost}}} \tag{20.1}$$

$$\text{Initial cash balance} = \sqrt{\frac{2 \times \text{annual cash outflows} \times \text{cost per sale of securities}}{\text{interest rate}}} \tag{20.2}$$

$$\text{Effective annual rate} = \left(1 + \frac{\text{discount}}{\text{discounted price}}\right)^{365/\text{extra days credit}} - 1 \tag{21.1}$$

$$\begin{aligned} &\text{Refuse credit: } 0 \\ &\text{Grant credit: } p \times \text{PV(REV} - \text{COST)} - (1 - p) \times \text{PV(COST)} \end{aligned} \tag{21.2}$$