***CHAPTER 9***

**STOCK VALUATION**

# Answers to Concept Questions

**1.** The value of any investment depends on the present value of its cash flows; i.e., what investors will actually receive. The cash flows from a share of stock are the dividends.

**2.** Investors believe the company will eventually start paying dividends (or be sold to another company).

**3.** In general, companies that need the cash will often forgo dividends since dividends are a cash expense. Young, growing companies with profitable investment opportunities are one example; another example is a company in financial distress. This question is examined in depth in a later chapter.

**4.** The general method for valuing a share of stock is to find the present value of all expected future dividends. The dividend growth model presented in the text is only valid (i) if dividends are expected to occur forever; that is, the stock provides dividends in perpetuity, and (ii) if a constant growth rate of dividends occurs forever. A violation of the first assumption might be a company that is expected to cease operations and dissolve itself some finite number of years from now. The stock of such a company would be valued by applying the general method of valuation explained in this chapter. A violation of the second assumption might be a start-up firm that isn’t currently paying any dividends, but is expected to eventually start making dividend payments some number of years from now. This stock would also be valued by the general dividend valuation method explained in this chapter.

**5.** The common stock probably has a higher price because the dividend can grow, whereas it is fixed on the preferred. However, the preferred is less risky because of the dividend and liquidation preference, so it is possible the preferred could be worth more, depending on the circumstances.

**6.** The two components are the dividend yield and the capital gains yield. For most companies, the capital gains yield is larger. This is easy to see for companies that pay no dividends. For companies that do pay dividends, the dividend yields are rarely over five percent and are often much less.

**7.** Yes. If the dividend grows at a steady rate, so does the stock price. In other words, the dividend growth rate and the capital gains yield are the same.

**8.** The three factors are: 1) The company’s future growth opportunities. 2) The company’s level of risk, which determines the interest rate used to discount cash flows. 3) The accounting method used.

**9.** It wouldn’t seem to be. Investors who don’t like the voting features of a particular class of stock are under no obligation to buy it.

**10.** Presumably, the current stock value reflects the risk, timing and magnitude of all future cash flows, both short-term and long-term. If this is correct, then the statement is false.

# Solutions to Questions and Problems

*NOTE: All end-of-chapter problems were solved using a spreadsheet. Many problems require multiple steps. Due to space and readability constraints, when these intermediate steps are included in this solutions manual, rounding may appear to have occurred. However, the final answer for each problem is found without rounding during any step in the problem.*

*Basic*

**1.** The constant dividend growth model is:

P*t* = D*t* × (1 + *g*) / (*R* – *g*)

So, the price of the stock today is:

P0 = D0(1 + *g*) / (*R* – *g*) = $1.95(1.045) / (.11 – .045)

P0 = $31.35

The dividend at Year 4 is the dividend today times the FVIF for the growth rate in dividends and four years, so:

P3 = D3(1 + *g*) / (*R* – *g*) = D0(1 + g)4 / (*R* – *g*)

P3 = $1.95(1.045)4 / (.11 – .045)

P3 = $35.78

We can do the same thing to find the dividend in Year 16, which gives us the price in Year 15, so:

P15 = D15(1 + *g*) / (*R* – *g*) = D0(1 + g)16 / (*R* – *g*)

P15 = $1.95 (1.045)16 / (.11 – .045)

P15 = $60.67

There is another feature of the constant dividend growth model: The stock price grows at the dividend growth rate. So, if we know the stock price today, we can find the future value for any time in the future we want to calculate the stock price. In this problem, we want to know the stock price in three years, and we have already calculated the stock price today. The stock price in three years will be:

P3 = P0(1 + *g*)3

P3 = $31.35(1 + .045)3

P3 = $35.78

And the stock price in 15 years will be:

P15 = P0(1 + *g*)15

P15 = $31.35(1 + .045)15

P15 = $60.67

**2.** We need to find the required return of the stock. Using the constant growth model, we can solve the equation for *R*. Doing so, we find:

*R* = (D1 / P0) + *g*

*R* = ($2.90 / $53.10) + .055

*R* = .1096, or 10.96%

**3.** The dividend yield is the dividend next year divided by the current price, so the dividend yield is:

Dividend yield = D1 / P0

Dividend yield = $2.90 / $53.10

Dividend yield = .0546, or 5.46%

The capital gains yield, or percentage increase in the stock price, is the same as the dividend growth rate, so:

Capital gains yield = 5.5%

**4.** Using the constant growth model, we find the price of the stock today is:

P0 = D1 / (*R* – *g*)

P0 = $2.75 / (.11 – .05)

P0 = $45.83

**5.** The required return of a stock is made up of two parts: The dividend yield and the capital gains yield. So, the required return of this stock is:

*R* = Dividend yield + Capital gains yield

*R* = .046 + .057

*R* = .1030, or 10.30%

**6.** We know the stock has a required return of 10.8 percent, and the dividend and capital gains yield are equal, so:

Dividend yield = 1/2(.108) = .054 = Capital gains yield

Now we know both the dividend yield and capital gains yield. The dividend is the stock price times the dividend yield, so:

D1 = .054($67) = $3.62

This is the dividend next year. The question asks for the dividend this year. Using the relationship between the dividend this year and the dividend next year:

D1 = D0(1 + *g*)

We can solve for the dividend that was just paid:

$3.62 = D0 (1 + .054)

D0 = $3.62 / 1.054

D0 = $3.43

**7.** The price of any financial instrument is the PV of the future cash flows. The future dividends of this stock are an annuity for 13 years, so the price of the stock is the PVA, which will be:

P0 = $9(PVIFA9.5%,13)

P0 = $65.62

**8.** The price of a share of preferred stock is the dividend divided by the required return. This is the same equation as the constant growth model, with a dividend growth rate of zero percent. Remember that most preferred stock pays a fixed dividend, so the growth rate is zero. Using this equation, we find the price per share of the preferred stock is:

*R* = D / P0

*R* = $4.50 / $87

*R* = .0517, or 5.17%

**9.** The growth rate of earnings is the return on equity times the retention ratio, so:

*g* = ROE × *b*

*g* = .17(.80)

*g* = .1360, or 13.60%

To find next year’s earnings, we multiply the current earnings times one plus the growth rate, so:

Next year’s earnings = Current earnings(1 + *g*)

Next year’s earnings = $29,000,000(1 + .1360)

Next year’s earnings = $32,944,000

**10.** Using the equation to calculate the price of a share of stock with the PE ratio:

P = Benchmark PE ratio × EPS

So, with a PE ratio of 18, we find:

P = 18($2.35)

P = $42.30

And with a PE ratio of 21, we find:

P = 21($2.35)

P = $49.35

*Intermediate*

**11.** This stock has a constant growth rate of dividends, but the required return changes twice. To find the value of the stock today, we will begin by finding the price of the stock at Year 6, when both the dividend growth rate and the required return are stable forever. The price of the stock in Year 6 will be the dividend in Year 7, divided by the required return minus the growth rate in dividends. So:

P6 = D6 (1 + *g*) / (*R* – *g*) = D0 (1 + *g*)7 / (*R* – *g*)

P6 = $2.90(1.06)7 / (.11 – .06)

P6 = $87.21

Now we can find the price of the stock in Year 3. We need to find the price here since the required return changes at that time. The price of the stock in Year 3 is the PV of the dividends in Years 4, 5, and 6, plus the PV of the stock price in Year 6. The price of the stock in Year 3 is:

P3 = $2.90(1.06)4 / 1.13 + $2.90(1.06)5 / 1.132 + $2.90(1.06)6 / 1.133 + $87.21 / 1.133

P3 = $69.57

Finally, we can find the price of the stock today. The price today will be the PV of the dividends in Years 1, 2, and 3, plus the PV of the stock in Year 3. The price of the stock today is:

P0 = $2.90(1.06) / 1.15 + $2.90(1.06)2 / (1.15)2 + $2.90(1.06)3 / (1.15)3 + $69.57 / (1.15)3

P0 = $53.15

**12.** Here we have a stock that pays no dividends for 9 years. Once the stock begins paying dividends, it will have a constant growth rate of dividends. We can use the constant growth model at that point. It is important to remember that the general form of the constant dividend growth formula is:

P*t* = [D*t* × (1 + *g*)] / (*R* – *g*)

This means that since we will use the dividend in Year 10, we will be finding the stock price in Year 9. The dividend growth model is similar to the PVA and the PV of a perpetuity: The equation gives you the PV one period before the first payment. So, the price of the stock in Year 9 will be:

P9 = D10 / (*R* – *g*)

P9 = $17.50 / (.12 – .055)

P9 = $269.23

The price of the stock today is the PV of the stock price in the future. We discount the future stock price at the required return. The price of the stock today will be:

P0 = $269.23 / 1.129

P0 = $97.09

**13.** The price of a stock is the PV of the future dividends. This stock is paying five dividends, so the price of the stock is the PV of these dividends using the required return. The price of the stock is:

P0 = $13 / 1.12 + $17 / 1.122 + $21 / 1.123 + $25 / 1.124 + $29 / 1.125

P0 = $72.45

**14.** With differential dividends, we find the price of the stock when the dividends level off at a constant growth rate, and then find the PV of the future stock price, plus the PV of all dividends during the differential growth period. The stock begins constant growth in Year 5, so we can find the price of the stock in Year 4, one year before the constant dividend growth begins, as:

P4 = D4 (1 + *g*) / (*R* – *g*) = $2.40(1.045) / (.11 – .045)

P4 = $38.58

The price of the stock today is the PV of the first four dividends, plus the PV of the Year 4 stock price. So, the price of the stock today will be:

P0 = $13 / 1.11 + $8 / 1.112 + $6.50 / 1.113 + ($2.40 + 38.58) / 1.114

P0 = $49.96

**15.** With differential dividends, we find the price of the stock when the dividends level off at a constant growth rate, and then find the PV of the future stock price, plus the PV of all dividends during the differential growth period. The stock begins constant growth in Year 4, so we can find the price of the stock in Year 3, one year before the constant dividend growth begins as:

P3 = D3 (1 + *g*) / (*R* – *g*) = D0 (1 + *g1*)3 (1 + *g2*) / (*R* – *g2*)

P3 = $3.10(1.25)3(1.05) / (.12 – .05)

P3 = $90.82

The price of the stock today is the PV of the first three dividends, plus the PV of the Year 3 stock price. The price of the stock today will be:

P0 = $3.10(1.25) / 1.12 + $3.10(1.25)2 / 1.122 + $3.10(1.25)3 / 1.123 + $90.82 / 1.123

P0 = $76.27

**16.** Here we need to find the dividend next year for a stock experiencing differential growth. We know the stock price, the dividend growth rates, and the required return, but not the dividend. First, we need to realize that the dividend in Year 3 is the current dividend times the FVIF. The dividend in Year 3 will be:

D3 = D0(1.30)3

And the dividend in Year 4 will be the dividend in Year 3 times one plus the growth rate, or:

D4 = D0(1.30)3 (1.18)

The stock begins constant growth after the 4th dividend is paid, so we can find the price of the stock in Year 4 as the dividend in Year 5, divided by the required return minus the growth rate. The equation for the price of the stock in Year 4 is:

P4 = D4(1 + *g*) / (*R* – *g*)

Now we can substitute the previous dividend in Year 4 into this equation as follows:

P4 = D0(1 + *g1*)3(1 + *g2*)(1 + *g3*) / (*R* – *g3*)

P4 = D0(1.30)3(1.18)(1.08) / (.11 – .08)

P4 = 93.33D0

When we solve this equation, we find that the stock price in Year 4 is 93.33 times as large as the dividend today. Now we need to find the equation for the stock price today. The stock price today is the PV of the dividends in Years 1, 2, 3, and 4, plus the PV of the Year 4 price. So:

P0 = D0(1.30)/1.11 + D0(1.30)2/1.112 + D0(1.30)3/1.113+ D0(1.30)3(1.18)/1.114 + 93.33D0/1.114

We can factor out D0 in the equation, and combine the last two terms. Doing so, we get:

P0 = $65.00 = D0{1.30/1.11 + 1.302/1.112 + 1.303/1.113 + [(1.30)3(1.18) + 93.33] / 1.114}

Reducing the equation even further by solving all of the terms in the braces, we get:

$65 = $67.34D0

D0 = $65.00 / $67.34

D0 = $.97

This is the dividend today, so the projected dividend for the next year will be:

D1 = $.97(1.30)

D1 = $1.25

**17.** The constant growth model can be applied even if the dividends are declining by a constant percentage, just make sure to recognize the negative growth. So, the price of the stock today will be:

P0 = D0 (1 + *g*) / (*R* – *g*)

P0 = $13(1 – .04) / [.10 – (–.04)]

P0 = $89.14

**18.** We are given the stock price, the dividend growth rate, and the required return, and are asked to find the dividend. Using the constant dividend growth model, we get:

P0 = $64.87 = D0 (1 + *g*) / (*R* – *g*)

Solving this equation for the dividend gives us:

D0 = $64.87(.105 – .05) / (1.05)

D0 = $3.40

**19.** The price of a share of preferred stock is the dividend payment divided by the required return. We know the dividend payment in Year 5, so we can find the price of the stock in Year 4, one year before the first dividend payment. Doing so, we get:

P4 = $5.00 / .047

P4 = $106.38

The price of the stock today is the PV of the stock price in the future, so the price today will be:

P0 = $106.38 / (1.047)4

P0 = $88.53

**20.** The dividend yield is the annual dividend divided by the stock price, so:

Dividend yield = Dividend / Stock price

.021 = Dividend / $27.82

Dividend = $.58

The “Net Chg” of the stock shows the stock decreased by $.13 on this day, so the closing stock price yesterday was:

Yesterday’s closing price = $27.82 – (–.13)

Yesterday’s closing price = $27.95

To find the net income, we need to find the EPS. The stock quote tells us the PE ratio for the stock is 23. Since we know the stock price as well, we can use the PE ratio to solve for EPS as follows:

PE = Stock price / EPS

23 = $27.82 / EPS

EPS = $27.82 / 23

EPS = $1.210

We know that EPS is just the total net income divided by the number of shares outstanding, so:

EPS = Net income / Shares

$1.210 = Net income / 30,000,000

Net income = $1.210(30,000,000)

Net income = $36,286,957

**21.** Here we have a stock paying a constant dividend for a fixed period, and an increasing dividend thereafter. We need to find the present value of the two different cash flows using the appropriate quarterly interest rate. The constant dividend is an annuity, so the present value of these dividends is:

PVA = *C*(PVIFA*R,t*)

PVA = $.90(PVIFA2.5%,12)

PVA = $9.23

Now we can find the present value of the dividends beyond the constant dividend phase. Using the present value of a growing annuity equation, we find:

P12 = D13/ (*R* – *g*)

P12 = $.90(1 + .01) / (.025 – .01)

P12 = $60.60

This is the price of the stock immediately after it has paid the last constant dividend. So, the present value of the future price is:

PV = $60.60 / (1 + .025)12

PV = $45.06

The price today is the sum of the present value of the two cash flows, so:

P0 = $9.23 + 45.06

P0 = $54.29

**22.** Here we need to find the dividend next year for a stock with irregular growth in dividends. We know the stock price, the dividend growth rate, and the required return, but not the dividend. First, we need to realize that the dividend in Year 3 is the constant dividend times the FVIF. The dividend in Year 3 will be:

D3 = D(1.04)

The equation for the stock price will be the present value of the constant dividends, plus the present value of the future stock price, or:

P0 = D / 1.11 + D/ 1.112 + D[(1.04) / (.11 – .04)] / 1.112

$53 = D / 1.11 + D/ 1.112 + D[(1.04) / (.11 – .04)] / 1.112

We can factor out D0 in the equation. Doing so, we get:

$53 = D{1 / 1.11 + 1 / 1.112 + [(1.04) / (.11 – .04)] / 1.112}

Reducing the equation even further by solving all of the terms in the braces, we get:

$53 = D(13.7709)

D = $53 / 13.7709

D = $3.85

**23.** The required return of a stock consists of two components, the capital gains yield and the dividend yield. In the constant dividend growth model (growing perpetuity equation), the capital gains yield is the same as the dividend growth rate, or algebraically:

*R* = D1 / P0 + *g*

We can find the dividend growth rate by the growth rate equation, or:

*g* = ROE × *b*

*g* = .13 × .70

*g* = .0910, or 9.10%

This is also the growth rate in dividends. To find the current dividend, we can use the information provided about the net income, shares outstanding, and payout ratio. The total dividends paid is the net income times the payout ratio. To find the dividend per share, we can divide the total dividends paid by the number of shares outstanding. So:

Dividend per share = (Net income × Payout ratio) / Shares outstanding

Dividend per share = ($23,000,000 × .30) / 2,000,000

Dividend per share = $3.45

Now we can use the initial equation for the required return. We must remember that the equation uses the dividend in one year, so:

*R* = D1 / P0 + *g*

*R* = $3.45(1 + .0910) / $97 + .0910

*R* = .1298, or 12.98%

**24.** First, we need to find the annual dividend growth rate over the past four years. To do this, we can use the future value of a lump sum equation, and solve for the interest rate. Doing so, we find the dividend growth rate over the past four years was:

FV = PV(1 + *R*)*t*

$1.87 = $1.51(1 + *R*)4

*R* = ($1.87 / $1.51)1/4 – 1

*R* = .0549, or 5.49%

We know the dividend will grow at this rate for five years before slowing to a constant rate indefinitely. So, the dividend amount in seven years will be:

D7 = D0(1 + *g*1)5(1 + *g*2)2

D7 = $1.87(1 + .0549)5(1 + .05)2

D7 = $2.69

**25.** *a.* We can find the price of all the outstanding company stock by using the dividends the same way we would value an individual share. Since earnings are equal to dividends, and there is no growth, the value of the company’s stock today is the present value of a perpetuity, so:

P = D / *R*

P = $630,000 / .11

P = $5,727,272.73

The price-earnings ratio is the stock price divided by the current earnings, so the price–earnings ratio of each company with no growth is:

PE = Price / Earnings

PE = $5,727,272.73 / $630,000

PE = 9.09 times

*b.* Since the earnings have increased, the price of the stock will increase. The new price of the outstanding company stock is:

P = D / *R*

P = ($630,000 + 100,000) / .11

P = $6,636,363.64

The price–earnings ratio is the stock price divided by the current earnings, so the price­–earnings with the increased earnings is:

PE = Price / Earnings

PE = $6,636,363.64 / $630,000

PE = 10.53 times

*c.* Since the earnings have increased, the price of the stock will increase. The new price of the outstanding company stock is:

P = D / *R*

P = ($630,000 + 200,000) / .11

P = $7,545,454.55

The price–earnings ratio is the stock price divided by the current earnings, so the price–earnings with the increased earnings is:

PE = Price / Earnings

PE = $7,545,454.55 / $630,000

PE = 11.98 times

**26.** *a.* Using the equation to calculate the price of a share of stock with the PE ratio:

P = Benchmark PE ratio × EPS

So, with a PE ratio of 21, we find:

P = 21($3.10)

P = $65.10

*b.*  First, we need to find the earnings per share next year, which will be:

EPS1 = EPS0(1 + *g*)

EPS1 = $3.10(1 + .06)

EPS1 = $3.29

Using the equation to calculate the price of a share of stock with the PE ratio:

P1 = Benchmark PE ratio × EPS1

P1 = 21($3.29)

P1 = $69.01

*c.* To find the implied return over the next year, we calculate the return as:

*R* = (P1 – P0) / P0

*R* = ($69.01 – 65.10) / $65.10

*R* = .06, or 6%

Notice that the return is the same as the growth rate in earnings. Assuming a stock pays no dividends and the PE ratio is constant, this will always be true when using price ratios to evaluate the price of a share of stock.

**27.** We need to find the enterprise value of the company. We can calculate EBITDA as sales minus costs, so:

EBITDA = Sales – Costs

EBITDA = $42,000,000 – 13,000,000

EBITDA = $29,000,000

Solving the EV/EBITDA multiple for enterprise value, we find:

Enterprise value = $29,000,000(6.8)

Enterprise value = $197,200,000

The total value of equity is the enterprise value minus any outstanding debt, plus cash, so:

Equity value = Enterprise value – Debt + Cash

Equity value = $197,200,000 – 64,000,000 + 21,000,000

Equity value = $154,200,000

So, the price per share is:

Stock price = $154,200,000 / 1,750,000

Stock price = $88.11

**28.** *a.* To value the stock today, we first need to calculate the cash flows for the next 6 years. The sales, costs, and net investment all grow by the same rate, namely 14 percent, 12 percent, 10 percent, and 8 percent, respectively, for the following 4 years, then 6 percent indefinitely. So, the cash flows for each year will be:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | *Year 1* | *Year 2* | *Year 3* | *Year 4* | *Year 5* | *Year 6* |
|  | Sales | $135,000,000 | $153,900,000 | $172,368,000 | $189,604,800 | $204,773,184 | $217,059,575 |
|  | Costs | 76,000,000 | 86,640,000 | 97,036,800 | 106,740,480 | 115,279,718 | 122,196,502 |
|  | EBT | $59,000,000 | $67,260,000 | $75,331,200 | $82,864,320 | $89,493,466 | $94,863,074 |
|  | Taxes | 23,600,000 | 26,904,000 | 30,132,480 | 33,145,728 | 35,797,386 | 37,945,229 |
|  | Net income | $35,400,000 | $40,356,000 | $45,198,720 | $49,718,592 | $53,696,079 | $56,917,844 |
|  | Investment | 15,000,000 | 17,100,000 | 19,152,000 | 21,067,200 | 22,752,576 | 24,117,731 |
|  | Cash flow | $20,400,000 | $23,256,000 | $26,046,720 | $28,651,392 | $30,943,503 | $32,800,114 |

To find the terminal value of the company in Year 6, we can discount the Year 7 cash flows as a growing perpetuity, which will be:

Terminal value = $32,800,114(1 + .06) / (.13 – .06)

Terminal value = $496,687,434

So, the value of the company today is:

Company value today = $20,400,000 / 1.13 + $23,256,000 / 1.132 + $26,046,720 / 1.133

+ $28,651,392 / 1.134 + 30,943,503 / 1.135 + ($32,800,114 + 496,687,434) / 1.136

Company value today = $343,007,648

Dividing the company value by the shares outstanding to get the share price, we get:

Share price = $343,007,648 / 5,500,000

Share price = $62.37

*b.*  In this case, we are going to use the PE multiple to find the terminal value. All of the cash flows from part *a* will remain the same. So, the terminal value in Year 6 is:

Terminal value = 11($56,917,844)

Terminal value = $626,096,285

Under this assumption for the terminal value, the value of the company today is:

Company value today = $20,400,000 / 1.13 + $23,256,000 / 1.132 + $26,046,720 / 1.133

+ $28,651,392 / 1.134 + 30,943,503 / 1.135 + ($32,800,114 + 626,096,285) / 1.136

Company value today = $405,165,177

Dividing the company value by the shares outstanding to get the share price, we get:

Share price = $405,165,117 / 5,500,000

Share price = $73.67

*Challenge*

**29.** We are asked to find the dividend yield and capital gains yield for each of the stocks. All of the stocks have a 14 percent required return, which is the sum of the dividend yield and the capital gains yield. To find the components of the total return, we need to find the stock price for each stock. Using this stock price and the dividend, we can calculate the dividend yield. The capital gains yield for the stock will be the total return (required return) minus the dividend yield.

W: P0 = D0(1 + *g*) / (*R* – *g*) = $3.50(1.07) / (.14 – .07) = $53.50

Dividend yield = D1/P0 = 3.50(1.07) / $53.50 = .07, or 7%

Capital gains yield = .14 – .07 = .07, or 7%

X: P0 = D0(1 + *g*) / (*R* – *g*) = $3.50 / (.14 – 0) = $25.00

Dividend yield = D1/P0 = $3.50 / $25.00 = .14, or 14%

Capital gains yield = .14 – .14 = 0%

Y: P0 = D0(1 + *g*) / (*R* – *g*) = $3.50(1 – .05) / (.14 + .05) = $17.50

Dividend yield = D1/P0 = $3.50(.95) / $17.50 = .19, or 19%

Capital gains yield = .14 – .19 = –.05, or –5%

Z: P2 = D2(1 + *g*) / (*R* – *g*) = D0(1 + *g1*)2(1 + *g2*) / (*R* – *g*2) = $3.50(1.30)2(1.08) / (.14 – .08)

P2 = $106.47

P0 = $3.50(1.30) / (1.14) + $3.50 (1.30)2 / (1.14)2 + $106.47 / (1.14)2

P0 = $90.47

Dividend yield = D1/P0 = $3.50(1.30) / $90.47 = .0503, or 5.03%

Capital gains yield = .14 – .0503 = .0897, or 8.97%

In all cases, the required return is 14 percent, but the return is distributed differently between current income and capital gains. High-growth stocks have an appreciable capital gains component but a relatively small current income yield; conversely, mature, negative-growth stocks provide a high current income but also price depreciation over time.

**30.** *a*. Using the constant growth model, the price of the stock paying annual dividends will be:

P0 = D0(1 + *g*) / (*R* – *g*)

P0 = $3.60(1.045) / (.11 – .045)

P0 = $57.88

*b*. If the company pays quarterly dividends instead of annual dividends, the quarterly dividend will be one-fourth of the annual dividend, or:

Quarterly dividend: $3.60(1.045) / 4

Quarterly dividend = $.9405

To find the equivalent annual dividend, we must assume that the quarterly dividends are reinvested at the required return. We can then use this interest rate to find the equivalent annual dividend. In other words, when we receive the quarterly dividend, we reinvest it at the required return on the stock. So, the effective quarterly rate is:

Effective quarterly rate = 1.11.25 – 1

Effective quarterly rate = .0264, or 2.64%

The effective annual dividend will be the FVA of the quarterly dividend payments at the effective quarterly required return. In this case, the effective annual dividend will be:

Effective D1 = $.9405(FVIFA2.64%,4)

Effective D1 = $3.91

Now, we can use the constant growth model to find the current stock price as:

P0 = $3.91 / (.11 – .045)

P0 = $60.21

Note that we cannot find the quarterly effective required return and growth rate to find the value of the stock. This would assume the dividends increased each quarter, not each year.

The value of the stock is the PV of the firm without making the investment plus the NPV of the investment, or:

P = PV(EPS) + NPVGO

P = $70.83 – 2.26

P = $68.57

*c.* Zero percent! There is no retention ratio which would make the project profitable for the company. If the company retains more earnings, the growth rate of the earnings on the investment will increase, but the project will still not be profitable. Since the return of the project is less than the required return on the company stock, the project is never worthwhile. In fact, the more the company retains and invests in the project, the less valuable the stock becomes.

**31.** Here we have a stock with differential growth, but the dividend growth changes every year for the first four years. We can find the price of the stock in Year 3 since the dividend growth rate is constant after the third dividend. The price of the stock in Year 3 will be the dividend in Year 4, divided by the required return minus the constant dividend growth rate. So, the price in Year 3 will be:

P3 = $3.40(1.20)(1.15)(1.10)(1.05) / (.13 – .05)

P3 = $67.74

The price of the stock today will be the PV of the first three dividends, plus the PV of the stock price in Year 3, so:

P0 = $3.40(1.20) / (1.13) + $3.40(1.20)(1.15) / 1.132 + $3.40(1.20)(1.15)(1.10) / 1.133

+ $67.74 / 1.133

P0 = $57.81

**32.** Here we want to find the required return that makes the PV of the dividends equal to the current stock price. The equation for the stock price is:

P = $3.40(1.20) / (1 + *R*) + $3.40(1.20)(1.15) / (1 + *R*)2 + $3.40(1.20)(1.15)(1.10) / (1 + *R*)3

+ [$3.40(1.20)(1.15)(1.10)(1.05) / (*R* – .05)] / (1 + *R*)3 = $62.40

We need to find the roots of this equation. Using a spreadsheet, trial and error, or a calculator with a root solving function, we find that:

*R* = .1242, or 12.42%

**33.** *a.* If the company does not make any new investments, the stock price will be the present value of the constant perpetual dividends. In this case, all earnings are paid as dividends, so, applying the perpetuity equation, we get:

P = Dividend / *R*

P = $8.20 / .12

P = $68.33

*b.* The investment is a one-time investment that creates an increase in EPS for two years. To calculate the new stock price, we need the cash cow price plus the NPVGO. In this case, the NPVGO is the present value of the investment plus the present value of the increases in EPS. So, the NPVGO will be:

NPVGO = C1 / (1 + *R*) + C2 / (1 + *R*)2 + C3 / (1 + *R*)3

NPVGO = –$1.95 / 1.12 + $2.75 / 1.122 + $3.05 / 1.123

NPVGO = $2.62

So, the price of the stock if the company undertakes the investment opportunity will be:

P = $68.33 + 2.62

P = $70.96

*c.* After the project is over, and the earnings increase no longer exists, the price of the stock will revert back to $68.33, the value of the company as a cash cow.

**34.** In this problem, growth is occurring from two different sources: The learning curve and the new project. We need to separately compute the value from the two different sources. First, we will compute the value from the learning curve, which will increase at 5 percent. All earnings are paid out as dividends, so we find the earnings per share are:

EPS1 = Earnings / Total number of outstanding shares

EPS1 = ($21,000,000 × 1.05) / 7,500,000

EPS1 = $2.94

From the NPVGO model:

P = E / (*R* – *g*) + NPVGO

P = $2.94 / (.10 – .05) + NPVGO

P = $58.80 + NPVGO

Now we can compute the NPVGO of the new project to be launched two years from now. The earnings per share two years from now will be:

EPS2 = $2.94(1 + .05)

EPS2 = $3.087

Therefore, the initial investment in the new project will be:

Initial investment = .30($3.087)

Initial investment = $.93

The earnings per share of the new project are a perpetuity, with an annual cash flow of:

Increased EPS from project = $6,700,000 / 7,500,000 shares

Increased EPS from project = $.89

So, the value of all future earnings in Year 2, one year before the company realizes the earnings, is:

PV = $.89 / .10

PV = $8.93

Now, we can find the NPVGO per share of the investment opportunity in Year 2, which will be:

NPVGO2 = –$.93 + 8.93

NPVGO2 = $8.01

The value of the NPVGO today will be:

NPVGO = $8.01 / (1 + .10)2

NPVGO = $6.62

Plugging in the NPVGO model we get:

P = $58.80 + 6.62

P = $65.42

Note that you could also value the company and the project with the values given, and then divide the final answer by the shares outstanding. The final answer would be the same.