Investment Formula Quiz

Dividend Discount Model Formula (DDM) or Constant Growth Model

The dividend discount model is a method of valuing the price of a company's stock based on the fact that its stock is worth the sum of all of its future dividend payments, discounted back to their present value.

$$V = \frac{D_1}{r - g}$$

Required Rate of Return formula

$$r = \frac{D_1}{P} + g$$

Covariance

$$COV_{ij} = \rho_{ij}\sigma_i\sigma_j$$

Standard Deviation of Two Assets (based on weighting)

$$\sigma_p = \sqrt{W_i^2\sigma_i^2 + W_j^2\sigma_j^2 + 2W_iW_jCOV_{ij}}$$

Beta

$$\beta_i = \frac{COV_{im}}{\sigma_m^2} = \frac{\rho_{im}\sigma_i}{\sigma_m}$$

Required Rate of Return

$$r_i = r_f + (r_m - r_f)\beta_i$$

Alpha (Jensen)

$$\alpha_p = \overline{r_p} - \left[\overline{r_f} + \left(\overline{r_m} - \overline{r_f}\right)\beta_p\right]$$

Treynor ratio

$$T_p = \frac{\overline{r_p} - \overline{r_f}}{\beta_p}$$

Change in Price of a Bond

$$\frac{\Delta P}{P} = -D\left[\frac{\Delta y}{1+y}\right]$$

Tax-Equivalent Yield

$$\text{TEY} = \text{r}/(1\text{-t})$$

Sharpe Ratio

$$S_p = \frac{\overline{r_p} - \overline{r_f}}{\sigma_p}$$

1. Assuming the standard deviation of the stock "*i*" is .3 and the standard deviation of the stock "*j*" is .25, what is the covariance if the correlation coefficient (ρ_{ij}) between the two stocks is .5?

   A. .075
   B. .150
   C. .0625
   D. .0375

2. If the standard deviation of stock "*i*" is .4 and the standard deviation of stock "*j*" is .35, what is the correlation coefficient (ρ_{ij}) if the covariance between the stocks is .0875?

   A. .14
   B. .625
   C. .01225
   D. 1.6

3. What is the standard deviation for the following set of numbers? {-20, 15, 8, 3, -5, 26}

   A. 15.98
   B. 11.41
   C. 15.30
   D. 9.06

4.

Given	Expected Return (E_r)	Risk
Stock A	10%	20%
Stock B	18%	32%

   If you own both Stock A and Stock B equally, what is the portfolio risk if the correlation coefficient is 0.8?

   A. 31-35%
   B. 26-30%
   C. 16-20%
   D. 21-26%

5. Stock A has an average rate of return of 11% and a standard deviation of 22. Stock B has an average rate of return of 5% and a standard deviation of 12. Which one is relatively less risky?

   A. Stock A, because its standard deviation is higher
   B. Stock B, because its standard deviation is lower
   C. Stock A, because the Coefficient of Variation is lower
   D. Stock B, because the Coefficient of Variation is higher

6. What is the beta of a stock when the standard deviation of the stock is 24%, the standard deviation of the market is 16%, and the correlation coefficient is .5?

   A. .33
   B. .75
   C. .50
   D. .875

7. If the standard deviation of the stock is 24% and the standard deviation of the market is 16%, what is the beta of the stock if the covariance of the stock to the market is .007?

   A. 3.6576
   B. .9524
   C. .0105
   D. .2734

8. Assume that MicroHard Corporation is currently paying a $3.50 per share in dividends and that investors expect dividends to grow at a rate of 5% per year for the foreseeable future. What is the estimated price of MicroHard if the market return is 9%, the risk-free rate is 3%, and the stock has a beta of 1.2?

   A. $70.67
   B. $67.31
   C. $87.50
   D. $91.88

9. If Microhard stock is selling for $80, would you suggest your client purchase it?

   A. No, because based on DDM, its true value should be $70.67
   B. Yes, because based on DDM, its true value should be $67.31
   C. No, because based on DDM, its true value should be $87.50
   D. Yes, because based on DDM, its true value should be $91.88

10. Due to the retro gaming phenomenon, ColecoVision is making a comeback. Their sales and profits are soaring…so much so that they are now paying a dividend of $1.00 per share. Investors are so excited that they expect dividends to rise at a healthy clip of 8% a year for the foreseeable future. Investors' required rate of return is 600 basis points above the T-bill rate of 4.5%. What is the fair market value of ColecoVision stock?

    A. $45.15
    B. $43.20
    C. $40.00
    D. $30.86

11. What is the investor's required rate of return for a stock that is paying a dividend of $1.50 per share and is expected to grow that dividend at 6% per year for the foreseeable future and is currently trading at $20?

    A. 6.08%
    B. 12.08%
    C. 7.95%
    D. 13.95%

12. What is the investor's required rate of return for a stock that has a market premium of 7%, a beta of 1.4, and a risk-free rate of 4%?

    A. 13.8%
    B. 8.2%
    C. 7.0%
    D. 9.8%

13. Christian Andrew has invested $130,000 into a bond with a coupon of 6%. According to his calculations, the bond has a YTC of 8% and a YTM of 7.25%. The bond has a duration of 15.8. How much will the bond price decrease if interest rates rise by 1%?

    A. $-14,731.93
    B. $-19,018.52
    C. $-19,151.52
    D. $-19,377.36

14. Roger Moore has invested $110,000 into a bond with a coupon of 5%. According to his calculations, the bond has a YTC of 3% and a YTM of 4.5%. The bond has a duration of 8.9. What percentage will the bond price change if interest rates decrease by 0.5%?

    A. +4.26%
    B. -4.26%
    C. +4.32%
    D. -4.32%

15. Vito Scaramucci is resident of New Jersey. Due to his booming protection services business, he is in the 37% federal tax bracket. New Jersey state tax is a flat 6.625%. Because of his high tax bracket, Vito decides to purchase Treasury Notes paying 5.5%. What is his tax-equivalent yield on those bonds?

    A. 2.40%
    B. 8.73%
    C. 5.89%
    D. 9.76%

16. Karis Choi is a South Carolina resident. Due to her new found success as a TikTok model, she finds herself in the 37% federal tax bracket. South Carolina imposes a 6.5% state tax. Due to her high tax bracket, she found some municipal bonds issued by the State of Illinois paying 7.75%. What is her tax-equivalent yield on those bonds?

    A. 12.30%
    B. 13.72%
    C. 8.29%
    D. 7.75%
    E. 0%, because she will never collect anything from that broke State.

17. Alyssa Mae is evaluating her mutual fund manager. The fund returned 9.5% last year when the risk-free rate was 2%, the market return was 12%, and the beta of the fund was 0.6. Did her mutual fund manager provide additional value to her?

    A. Yes, alpha was +1.5
    B. No, the manager underperformed the market by 2.5%
    C. Yes, the alpha was above the risk-free rate
    D. No, the beta demanded a return of 20%

18. What is the alpha of a manager whose fund returned 18% when the risk-rate was 3%, the market premium was 10% and beta was 1.8?

    A. 0
    B. +5
    C. +2.4
    D. -3

19. Fund A has the following annual returns of 10%, 12%, and -4%. The average rate of return on risk-free assets during the same period is 2.5% and the beta was 1.2. What is its Sharpe measure of performance?

    A. .6882
    B. .2711
    C. .4015
    D. .3732

20. Fund X has the following annual returns of 10%, 16%, 0%, -8%. The IRR over the 4 years was 4.09%. The average T-bill rate during that period of time was 50 basis points. The beta was 0.85 and the standard deviation was 10.63. Fund X has an R^2 with the market of .92. What is its Treynor ratio?

    A. .376
    B. .338
    C. 4.71
    D. 4.22

21. Felicia Flipper likes to buy and sell stocks on margin. She bought 100 shares of XYZ stock at $80/share on margin (the initial margin requirement is 50%). The margin interest was 9% annually. After 6 months, she sold her entire position for $100/share. What was Felicia's holding period return (HPR)?

    A. 22.75%
    B. 41.00%
    C. 45.50%
    D. 20.50%

22. Sandy Speculator is looking to make a quick buck playing the stock market. She calls her broker and puts in an order to buy 500 shares of GameStop stock on margin. GameStop is selling for $150/share but has an initial margin requirement of 70% due to its volatility and the annual margin interest is 12%. One month later, GameStop is trading at $250/share and Sandy sells her entire position. What is her holding period return (HPR)?

    A. 151.95%
    B. 38.62%
    C. 90.10%
    D. 94.81%

23. Marty McFly purchases 1,000 shares of Walmart, Inc at $80 per share on margin. The initial margin requirement is 50%. If the maintenance margin is 25%, what is the amount of the maintenance call if the stock drops to $50?

    A. $0
    B. $1,250
    C. $1,500
    D. $2,500

24. Based on the fact pattern in the previous question, Marty would like to know at what price will a margin call be triggered?

    A. $70.00
    B. $62.50
    C. $53.33
    D. $52.00

25. An investor purchases a bond for $1,050. The bond will mature at $1,000 in 10 years. The coupon of the bond is 6%. What is the Yield to Maturity (YTM) of this bond?

    A. 4.86%
    B. 5.35%
    C. 2.43%
    D. 2.67%

26. An investor purchases a bond for $950. The bond will mature at $1,000 in 15 years. The coupon of the bond is 4%. The bond can be called in 8 years for $1,100. What is the yield to call (YTC) of this bond?

    A. 5.79%
    B. 4.75%
    C. 4.93%
    D. 2.89%

Answer Key

Question 1: D

$$COV_{ij} = \rho_{ij}\sigma_i\sigma_j$$

= .5 x .3 x .25
= .0375

Answer: .0375

Question 2: B

$$COV_{ij} = \rho_{ij}\sigma_i\sigma_j$$

$$\rho_{ij} = \frac{cov_{ij}}{\sigma_i\sigma_j}$$

$$= \frac{.0875}{(.4 \times .35)}$$

= .625

Answer: .625

Question 3: A

HP 10B II	HP 12C
gold, clear all	f, CLX
20, +/-, Σ+	20, CHS, Σ+
15, Σ+	15, Σ+
8, Σ+	8, Σ+
3, Σ+	3, Σ+
5, +/-, Σ+	5, CHS, Σ+
26, Σ+	26, Σ+
gold, S_x,S_y (under 8 key)	g, s (under . key)

Answer: 15.98

Question 4: D

Use the shortcut. If the correlation coefficient is +1.0 the risk of the portfolio is the average risk (20 + 32) ÷ 2 = 26%. Since correlation coefficient is less than +1.0, the risk of the portfolio as a whole is less than the risk of the average risk of the portfolio.

$$\sigma_p = \sqrt{W_i^2\sigma_i^2 + W_j^2\sigma_j^2 + 2W_iW_jCOV_{ij}}$$

= $\sqrt{}$ $(.5)^2(.2)^2 + (.5)^2(.32)^2 + 2(.5)(.5)(.05120)$** **use the COV formula to get COV

Answer: .2474 or 24%

Question 5: C

To determine which stock is riskier, apply a ***relative*** measure of variability. The Coefficient of Variation (CV) measures relative variability to compare investments with varying rates of return and standard deviations.

CV = σ ÷ Expected Return

Stock A has a CV of: 22/11 = 2
Stock B has a CV of: 12/5 = 2.4

Stock A is less risky than Stock B because the Coefficient of Variation is lower.

Question 6: B

$$\beta_i = \frac{COV_{im}}{\sigma_m^2} = \frac{\rho_{im}\sigma_i}{\sigma_m}$$

β_I = $\frac{.5 \times .24}{.16}$

Answer: .75

Question 7: D

$$\beta_i = \frac{COV_{im}}{\sigma_m^2} = \frac{\rho_{im}\sigma_i}{\sigma_m}$$

β_I = $\frac{.007}{(.16)^2}$

Answer: .2734

Question 8: A

The Constant Growth Model or Dividend Discount Model (DDM) formula is required.

$$V = \frac{D_1}{r-g}$$

But first we must solve for *r*, which is the required rate of return.

$$r_i = r_f + (r_m - r_f)\beta_i$$

= 3 + (9-3)1.2
= 10.2%, or .102

Then plug "*r*" into the DDM formula:

$$V = \frac{D_1}{r-g}$$

= $\frac{3.5\ (1+.05)}{.102 - .05}$

Answer: 70.67

Question 9: A

In Question 8, we found that the fair value of MicroHard should be $70.67. If the stock is selling for $80, it is overvalued by almost $10 and should NOT be purchased.

Question 10: B

Since we are given the required rate of return, we don't have to solve for that. We can plug that directly into the DDM formula.

$$V = \frac{D_1}{r - g}$$

$$= \frac{D_0 (1 + g)}{r\text{-}g}$$

$$= \frac{1 (1+.08)}{(.105 - .08)}$$

Answer: $43.20

Question 11: D

$$r = \frac{D_1}{P} + g$$

$$= \frac{1.5 (1+.06)}{20} + .06$$

Answer: .1395, or 13.95%

Question 12: A

$$r_i = r_f + (r_m - r_f)\beta_i$$

= .04 + (.07)1.4, where $(r_m - r_f)$ is the market premium

Answer: .138, or 13.8%

Question 13: C

$$\frac{\Delta P}{P} = -D\left[\frac{\Delta y}{1+y}\right]$$

= -15.8 (1/(1+.0725))

= -14.7319%

= $130,000 x -14.7319%

Answer: $-19,151.52

Question 14: A

$$\frac{\Delta P}{P} = -D\left[\frac{\Delta y}{1+y}\right]$$

= -8.9 (-0.5/(1+.045))

Answer: 4.26%

Question 15: C

$$\text{TEY} = \text{r}/(1\text{-t})$$

= 5.5/(1-.06625)

Answer: 5.89%

Remember, federal bonds pay federal taxes but don't pay state taxes.

Question 16: A (although answer E is perfectly acceptable)

$$TEY = r/(1\text{-}t)$$

Note that since Karis is a South Carolina resident buying Illinois municipal bonds, she will not get an exemption from paying South Carolina state taxes. If she had purchased South Carolina municipal bonds, her TEY would be 13.72% (Answer B).

= 7.75/(1-.37)

Answer: 12.30%

Question 17: A

$$\alpha_p = \overline{r_p} - \left[\overline{r_f} + \left(\overline{r_m} - \overline{r_f}\right)\beta_p\right]$$

Alpha is used to evaluate a manager performance relative to market while factoring in how much risk the manager took. A positive alpha indicates that the manager added value; whereas a negative alpha indicates the manager underperformed the market.

= 9.5 – (2 + (12 – 2)(0.6))

Answer: 1.5, this indicates that the manager outperformed the market relative to the risk he or she took to get the return.

Question 18: D

$$\alpha_p = \overline{r_p} - \left[\overline{r_f} + \left(\overline{r_m} - \overline{r_f}\right)\beta_p\right]$$

= 18 – (3 + (10)1.8)), remember that market premium is ($\bar{r}_m - \bar{r}_f$)

Answer: -3

Question 19: C

$$S_p = \frac{\overline{r_p} - \overline{r_f}}{\sigma_p}$$

$$= \frac{6 - 2.5}{8.7178}$$

Answer: .4015

To calculate $\bar{r}_p$ and σ_p

HP 10B II	HP 12C
gold, clear all	f, CLX
10, Σ+	10, Σ+
12, Σ+	12, Σ+
4, +/-, Σ+	4, CHS, Σ+
gold, $\bar{x}$,$\bar{y}$ (under 7 key)	g, $\bar{x}$ (under 0 key)
gold, S_x,S_y (under 8 key)	g, s (under . key)

Question 20: C

$$T_p = \frac{\overline{r_p} - \overline{r_f}}{\beta_p}$$

$$= \frac{4.5 - 0.5}{.85}$$

Answer: 4.71

To calculate $\bar{r}_p$

HP 10B II	HP 12C
gold, clear all	f, CLX
10, Σ+	10, Σ+
16, Σ+	16, Σ+
0, Σ+	0, Σ+
8, +/-, Σ+	8, CHS, Σ+
gold, $\bar{x}$,$\bar{y}$ (under 7 key)	g, $\bar{x}$ (under 0 key)

Question 21: C

Step 1: Felicia bought $8,000 worth of XYZ for $4,000 (50% margin)

Step 2: The interest she paid was $180. ($4,000 x 9% x .5) She only borrowed it for ½ year.

$$\text{HPR} = \frac{\$10{,}000 - (\$4{,}000 + \$180) - \$4{,}000}{\$4{,}000}$$

The first ($4,000 + $180) is used to pay back the margin loan plus interest. The second $4,000 is her initial investment. This is divided by her out-of-pocket cash outlay of $4,000.

$$= \frac{\$1{,}820}{\$4{,}000}$$

Answer: 45.50%

Question 22: D

Step 1: Sandy bought $75,000 worth of GameStop for $52,500. (70% margin requirement)

Step 2: The interest she paid was $225 i.e. ($22,500 x 12% x 1/12). She only borrowed it for 1/12 of the year.

$$\text{HPR} = \frac{\$125{,}000 - (\$22{,}500 + \$225) - \$52{,}500}{\$52{,}500}$$

The first ($22,500 + $225) is used to pay back the margin loan plus interest. The second $52,500 is her initial investment. This is divided by her out-of-pocket cash outlay of $52,500.

$$= \frac{\$49{,}775}{\$52{,}500}$$

Answer: 94.81%

Question 23: D

At $50/share, the shares are now worth $50,000. Marty still has a margin loan balance of $40,000 and his equity is $10,000.

25% of $50,000 $12,500 equity required
$50,000 - $40,000 $10,000 actual equity

Maintenance call of $2,500

Answer: $2,500

Question 24: C

Margin Maintenance Formula (**must memorize; not given on formula sheet**)

$$\text{Margin requirement} = \frac{(1 - \text{initial margin percentage})}{(1 - \text{maintenance percentage})} \times \text{purchase price of stock}$$

$$= \frac{(1 - .50)}{(1 - .25)} \times \$80/\text{share}$$

$$= \frac{.50}{.75} \times \$80/\text{share} = \$53.33$$

Answer: $53.33

Question 25: B

Elements:

Set to 2 P/Y
END MODE

Present Value	-1050
Future Value	1000
Payments	30
Number of Periods	10 (x 2 for 12C)
Interest	Solve (x 2 for 12C)

Keystrokes:

HP 10BII	HP 12C
gold, clear all	f, CLX
2, gold, P/YR	
1050, +/-, PV	1050, CHS, PV
1000, FV	1000, FV
10, gold, N	20, N
30, PMT	30, PMT
I/YR	i, ENTER, 2, x

Answer: 5.35%

Question 26: A

Elements:

Set to 2 P/Y
END Mode

Present Value	-950
Future Value	1100
Payments	20
Number of Periods	8 (x 2 for 12C)
Interest	Solve (x 2 for 12C)

Keystrokes:

gold, clear all	f, CLX
2, gold, P/Y	
950, +/-, PV	950, CHS, PV
1100, FV	1100, FV
8, gold, N	16, n
20, PMT	20, PMT
I/YR	i, ENTER, 2, x

Answer: 5.79%