Reading 2

THE TIME VALUE OF MONEY FINANCE

1. (A) $496.76.

   Explanation

   N = 8; I/Y = 12%; PMT = -$100; FV = 0; CPT → PV = $496.76.

   (Module 2.1, LOS 2.a)

2. (A) €125

   Explanation

   N = 15; I/Y = –1.5; FV = 100; PMT = 0; CPT PV = –125.45.

   (Module 2.1, LOS 2.a)

3. (C) $0, $25, $50, and $75

   Explanation

   The cash flow additivity principle states that the PV of any stream of cash flows is equal to the sum of the PVs of all of the cash flows. The cash flows are $50, $75, $100, and $125. So, if one stream of cash flows is equal to $50 each year, subtract $50 from each original cash flow to get the second stream of cash flows.

   The PV of 50, 75, 100, and 125 = PV of 50, 50, 50, and 50 + PV of 0, 25, 50, and 75.

   The order matters, as the PV will be different (and higher) if the higher cash flows come before the lower ones.

   (Module 2.2, LOS 2.c)

4. (B) $44.12.

   Explanation

   To calculate the price, we need to discount the future dividend stream at the investor's required return.

   The stream of dividends is a perpetuity (a fixed dividend each year forever).

   Given the PV of a perpetuity = cash flow / discount rate

   Then price = $3.75 / 0.085 = $44.12

   (Module 2.1, LOS 2.a)

5. (B) £978.

   Explanation

   N = 5; I/Y = 4.5; PMT = 40; FV = 1,000; CPT PV = –978.05.

   (Module 2.1, LOS 2.a)

6. (B) **$887.**

Explanation

Note that bond problems are just mixed annuity problems. You can solve bond problems directly with your financial calculator using all five of the main TVM keys at once. For bondtypes of problems the bond's price (PV) will be negative, while the coupon payment (PMT) and par value (FV) will be positive.

N = 10; I/Y = 12; FV = 1,000; PMT = 100; CPT → PV = – 886.99.

(Module 2.1, LOS 2.a)

7. (C) **required rate of return as the sum of its dividend yield and growth rate.**

Explanation

Starting with the Gordon growth model, we can solve for the estimated required rate of return, constant growth rate, or dividend yield as follows:

$$k_e = \frac{D_1}{V_0} + g_c$$

$$g_c = k_c - \frac{D_1}{V_0}$$

$$\frac{D_1}{V_0} = k_e - g_c$$

(Module 2.2, LOS 2.b)

8. (C) **$1,025.**

Explanation

With a fixed-coupon, annual-pay bond, the annual interest payment and the principal payment are discounted at the yield to maturity. The calculator solution is to solve for present value while setting the number of periods (N) to 6, the annual payment (PMT) to 50 (which is 1,000 × 5%), the future value (FV) to 1,000, and the yield (I/Y) to 4.5%:

$$\frac{50}{1.045} + \frac{50}{1.045^2} + \ldots + \frac{1{,}050}{1.045^6} = 1{,}025.79$$

This can also be answered using the calculator:

N = 6; I/Y = 4.5; PMT = 50; FV = 1,000. CPT

PV = –1,025.79.

It is also worth noting that because the yield to maturity (4.5%) is below the coupon rate (5%), the bond's current price must be above the par value of $1,000. $975 would only be possible if the yield was above the coupon rate.

(Module 2.1, LOS 2.a)

9. (B) 9.00%

Explanation

Because this is an annuity due (payments at the start of each period) the calculator must first be set to BGN mode.

N = 48; PMT = 500; FV = –29,000; PV = 0; CPT I/Y = 0.7532

This percentage is a monthly rate because the time periods were entered as 48 months. It must be converted to a stated annual percentage rate (APR) by multiplying by the number of compounding periods per year:

0.7532 × 12 = 9.04%.

(Module 2.2, LOS 2.b)

10. (B) $71,500

Explanation

$$\frac{\$100{,}000(0.05)}{0.07} = \$71{,}428.57.$$

(Module 2.1, LOS 2.a)

11. (A) 3.25%.

Explanation

A zero-coupon bond pays no interest, but it is most often purchased at a price heavily discounted from par value. The equation that shows the relationship between the present value (the purchase price), the future value, time, and yield to maturity is shown as follows:

$$\$726.27 = \frac{\$1{,}000}{(1+r)^{10}}$$

$$1 + r = \sqrt[10]{\frac{1{,}000}{726.27}}$$

r = 1.0325 − 1 = 0.0325, or 3.25

This can also be answered using the calculator:

N = 10; PV = –726.27; PMT = 0; FV = 1,000.

CPT I/Y = 3.25.

2.75% is the yield to maturity if the present value is incorrectly input as $762.27 instead of $726.27. The yield on similar bonds does not reflect the yield on a specific bond.

(Module 2.1, LOS 2.a)

12. (B) 12.34%

Explanation

The Gordon growth model, also known as the DDM, takes the next period's dividend and divides it by the difference between the required return and the growth rate. The formula can be algebraically manipulated to isolate the required rate of return. The calculation to determine the required rate of return is shown:

$$k = \frac{D_1}{V_0} + g_c = \frac{1.50(1.045)}{20} + 0.045 = 0.1234, Or 12.34$$

The 11.68% answer option is the output if the current dividend is discounted by the growth rate rather than increased by the growth rate to get to the next period's dividend. The 12.00% answer option is the output if the current dividend is used in the calculation without adjusting for the growth rate.

(Module 2.2, LOS 2.b)

13. (B) lower than $365,000.

Explanation

With a future value of $500,000, a present value of $365,000, and a maturity of 10 years, the annualized rate of return is calculated as shown:

$$\frac{\$500,000}{(1+r)^{10}} = \$365,000$$

$$(1+r)^{10} = \frac{\$500,000}{\$365,000} = 1.36986$$

$r = 1.36986^{1/10} - 1 = 0.0320$

On the calculator, N = 10; PV = –365,000; PMT = 0; FV = 500,000; CPT I/Y= 3.2.

Because the annualized return is 3.20% and the question asks about what the bond's price must be to be above 3.20%, the price of the bond must be below the purchase price of $365,000. The relationship between the price and rate of return is inverse; for the rate of return to be above 3.20%, the price must fall.

(Module 2.2, LOS 2.b)

14. (A) greater than 6%

Explanation

No calculations are needed to answer this question. This bond was issued at a price of $9,500, which is below face value of $10,000. The bond is considered a discount bond, and this results from a situation where the bond's coupon rate is below the yield to maturity. With annual interest of $600 on a face value of $10,000, the coupon rate is equal to 6% (600 / 10,000). The yield to maturity must be greater than 6% for the bond to be issued at a discounted price.

(Module 2.1, LOS 2.a)

15. (C) 4.0%.

Explanation

$$(1+r)^9 = \frac{500}{350}$$

$$r = \left(\frac{500}{350}\right)^{\frac{1}{9}} - 1 = 4.04\%.$$

(Module 2.2, LOS 2.b)

16. (C) increased.

Explanation

Bond prices and yields move in opposite directions, such that if the yield has dropped from 4.2% to 3.8%, it must be a case that the price of the bond has increased. A decrease in price would align with an increase in yield to maturity. If the price had remained flat, the yield would be unchanged.

(Module 2.2, LOS 2.b)

17. (B) $432.

Explanation

N = 3; I/Y = 5; FV = 500; PMT = 0; CPT → PV = 431.92.

or: $500/1.05^3 = 431.92$.

(Module 2.1, LOS 2.a)

18. (A) The expected rate on a 1-year bond one year from today is equal to 7.76%

Explanation

Implied forward rates can be derived based on observable spot rates in the fixed income market. The result is that the implied 1-year forward rate one year in the future can be derived based on this formula:

$$\frac{(1+S_2)^2}{(1+S_1)} = (1+1y1y)$$

$$\frac{(1.065)^2}{1.0525} - 1 = 0.0776$$

The forward rate (1y1y) is equal to 7.76%.

The forward rate will be higher than both spot rates, which means it cannot be between 5.25% and 6.50%. The investor should be indifferent between the 2-year bond paying 6.50% and 1-year bonds at 5.25% and 7.76%.

(Module 2.2, LOS 2.c)

19. (B) 3.2%.

Explanation

$$F_{1,1} = \frac{(1+r_2)^2}{(1+r_1)^1} - 1 = \frac{1.025^2}{1.018^1} - 1 = 3.2\%$$

(Module 2.2, LOS 2.c)

20. (A) $46.

Explanation

The value of preferred stock, based on the assumption that the annual dividend will be paid in perpetuity, is equal to:

The correct answer is 45.71, which is closest to $46 per share.

$$\frac{D_P}{K_P} = \frac{3.20}{0.07} = 45.71$$

(Module 2.1, LOS 2.a)

21. (B) $80.00.

Explanation

Applying the Gordon growth model, $\frac{\$2.40}{0.07 - 0.04} = \$80$

(Module 2.1, LOS 2.a)

22. (B) $700.

Explanation

87.50 ÷ 0.125 = $700.

(Module 2.1, LOS 2.a)

23. (A) the dividend to be received next year.

Explanation

The Gordon growth model, also known as the constant growth dividend discount model (DDM), takes the next period's dividend and divides it by the difference between the required return and the growth rate. The growth rate is assumed to be constant, and it must be below the required return—or else the denominator of the calculation will be negative, making it invalid.

(Module 2.1, LOS 2.a)

24. (B) $87,105.21.

Explanation

N = 6, PMT = -$20,000, I/Y = 10%, FV = 0, Compute PV → $87,105.21.

(Module 2.1, LOS 2.a)

25. (B) $4,606.00.

Explanation

PV (1): N = 1; I/Y = 10; FV = -4,000; PMT = 0; CPT → PV = 3,636

PV (2): N = 2; I/Y = 10; FV = -2,000; PMT = 0; CPT → PV = 1,653

PV (3): 0

PV (4): N = 4; I/Y = 10; FV = 1,000; PMT = 0; CPT → PV = -683

Total PV = 3,636 + 1,653 + 0 – 683 = 4,606

(Module 2.2, LOS 2.c)

26. (A) 0.50%.

Explanation

The percentage difference between forward and spot exchange rates is approximately equal to the difference between the interest rates in the two countries. Although there is a more refined calculation, the difference between the forward and spot rates will be approximately equal to 4.0% – 3.5% = 0.50%.

3.75% is just the average of the two rates, and 7.50% adds them together instead of taking the difference.

(Module 2.2, LOS 2.c)

27. (B) $751.

Explanation

Compute the present value of the perpetuity at (t = 3). Recall, the present value of a perpetuity or annuity is valued one period before the first payment. So, the present value at t = 3 is 100 / 0.10 = 1,000. Now it is necessary to discount this lump sum to t = 0.

Therefore, present value at t = 0 is 1,000 / $(1.10)^3$ = 751.

(Module 2.1, LOS 2.a)

28. (C) 8.93%

Explanation

Because the price of the bond increases, the yield to maturity will fall from its current level. The current level is 9.50%, which means the yield cannot be 10.07%. The calculation for the yield can be derived using a financial calculator:

PV = –963.75

FV = 1,000.00

N = 5 years

PMT = 80 (8% of par)

Solve for I/Y = 8.93.

(Module 2.2, LOS 2.b)

29. (A) 6.9%.

Explanation

4.5 / 65 = 0.0692, or 6.92%.

(Module 2.1, LOS 2.a)

30. (B) The investor should choose Opportunity 1.

Explanation

Although this problem may be solved by calculating the individual NPVs of each opportunity (Opportunity 1: 221.86 and Opportunity 2: 204.89), another approach would be to use the cash flow additivity principle as follows:

	Time 1	Time 2	Time 3
Opportunity 1	500,000	500,000	500,000
Opportunity 2	400,000	500,000	600,000
Cash flow difference	+100,000 0	0	–100,000

Because the present value of the cash flow difference arising at Time 1 (in favor of Opportunity 1) must exceed the present value of the negative cash flow difference arising at Time 3 (in favor of Opportunity 2) at any positive discount rate, Opportunity 1 is preferred.
(Module 2.2, LOS 2.c).

31. (B) ¥70 million.
Explanation
¥100,000,000$(1.03)^{-12}$ = ¥70,137,988.
(Module 2.1, LOS 2.a)

32. (A) 1.75%.
Explanation
The Gordon growth model, also known as the DDM, takes the next period's dividend and divides it by the difference between the required return and the growth rate. The formula can be algebraically manipulated to isolate the implied growth rate. The calculation to determine the growth rate is shown:

$$g_c = k_e - \frac{D_1}{V_0} = 0.0975 - \frac{2.40}{30} 0.0975 - 0.08 = 0.0175, \text{or } 1.75$$

The 1.83% answer option takes the correct answer of 1.75% and adds the dividend yield of 8%: 1.75% + 0.08% = 1.83%. The 1.89% answer option takes the correct answer of 1.75% and grows it by multiplying it by the dividend yield of 8%: 1.75% × (1.08) = 1.89%.
(Module 2.2, LOS 2.b)

33. (C) $7,829.00.
Explanation
25,458 / 1.14^9 = 7,828.54
Alternatively, N = 9; I/Y = 14; FV = -25,458; PMT = 0; CPT → PV = $7,828.54.
(Module 2.1, LOS 2.a)

34. (C) Act quickly by buying the lower-priced investment, as the prices will quickly converge.
Explanation
The no-arbitrage principle (law of one price) states that the price for an investment will be the same if two sets of future cash flows are identical under all conditions. Although there should not be a discrepancy in theory, there may be one for a short time period. If there is a slight price discrepancy between these investments, it will not last long, so the investor should act quickly and buy the lower-priced investment. The prices would not further diverge.
(Module 2.2, LOS 2.c)

35. (C) 7.3%.

Explanation

To calculate the implied cost of equity, we rearrange the constant growth formulas follows:

$$r = \frac{D_0 x(1+g)}{P_0} + g = \frac{1.50 X 1.04}{47.00} + 0.04 = 7.32\%$$

(Module 2.2, LOS 2.b)

36. (A) 5.2%.

Explanation

N = 7; PMT = 60; FV = 1,000; PV = –1,045; CPT I/Y = 5.2162.

(Module 2.2, LOS 2.b)

37. (A) $334.

Explanation

I = 12 / 12 = 1; N = 5 × 12 = 60; PV = 15,000; CPT → PMT = 333.67

(Module 2.1, LOS 2.a)

38. (A) €1.13 million.

Explanation

Given these three answer choices, you can choose the correct answer without performing the calculation. With a negative yield, the price of a single future cash flow must be greater than the amount of the cash flow. In this case, €1,000,000 $(1\ 0.015)^{-8}$ = €1,128,522.

(Module 2.1, LOS 2.a)