Course 2 Solutions
November 2001 Exams

1.	E

$$\int \frac{t^2}{100} dt = \frac{t^3}{300}$$

$$100 e^{t^3/300} \Big]_0^3 = 109.41743$$

$$\left(109.41743 + X\right) e^{t^3/300} \Big]_3^6 - \left(109.41743 + X\right) = X$$

$$\left(109.41743 + X\right)\left(1.8776106\right) - 109.41743 - X = X$$

$$96.025894 = 0.1223894 \, X$$

$$X = 784.59$$

2.	C

The equimarginal principle suggests that the ratio of the inputs' marginal products equals the ratio of the input prices. Hence, $10/5 = 20/10$.

This material was not on the November 2001 Course 2 syllabus.

3.	B

$$\frac{\Delta Y}{Y} - (\alpha_N)\frac{\Delta N}{N} - (1-\alpha_N)\frac{\Delta K}{K} = 2.6 - (0.7)(2.0) - (1-0.7)(4.0) = 2.6 - 1.4 - 1.2 = 0.0$$

4.	C

APV = Base-case NPV + PV tax shield
$$= \left(-100,000 + \frac{120,000}{1.2}\right) + \left(\frac{0.35 \times 0.08 \times 0.54(100,000)}{1.08}\right) = 0 + 1,400 = 1,400 \ .$$

5.   A

Present value $= 10 \cdot a_{\overline{5}|9.2} + 10 \cdot V_{9.2}^5 \sum_{t=1}^{\infty} \left[\frac{(1+k)}{(1.092)} \right]^t = 38.70 + \frac{(6.44)(1+k)}{0.092 - k} = 167.50$

$20 = \left(\frac{1+k}{0.092 - k} \right)$

$0.84 = 21k$

$k = 0.04$

Answer is 4.0% .

6.   B

Option 1: $2000 = Pa_{\overline{10}|0.0807}$

$P = 299 \Rightarrow$ Total payments $= 2990$

Option 2: Interest needs to be 990

$990 = i[2000 + 1800 + 1600 + \cdots + 200]$

$= i[11,000]$

$i = 0.09$

7.   D

Since the quantity purchased/sold decreases more from a tax increase when the demand curve is almost flat than when it is steep, more taxes are collected from products that have a steep demand curve.

8. D

Let i = IRR . For Project X, "i" solves the equation

$$\frac{300}{(1+i)^{1/2}-1} = 5000 .$$

$$(1+i)^{1/2} - 1 = \frac{300}{5000} = 6\% \Rightarrow I = 12.36\% .$$

For Project Y, $\dfrac{Z}{(1+i)^5} = \dfrac{Z}{(1.1236)^5} = 5000 \Rightarrow Z = 8954.23 .$

Project Y profitability index, at 10%:

$$\frac{NPV}{5000} = \frac{8954.23\left(V_{10}^5\right) - 5000}{5000} = 11.2\%$$

9. B

The point of this question is to test whether a student can determine the outstanding balance of a loan when the payments are not level.

Monthly payment at time $t = 1000(0.98)^{t-1}$

Since the actual amount of the loan is not given, the outstanding balance must be calculated prospectively,

OB_{40} = present value of payments at time 41 to time 60
= $1000(0.98)^{40}(1.0075)^{-1} + 1000(0.98)^{41}(1.0075)^{-2} + ... + 1000(0.98)^{59}(1.0075)^{-20}$

This is the sum of a geometric series, with
first term, $a = 1000(0.98)^{40}(1.0075)^{-1}$
common ratio, $r = (0.98)(1.0075)^{-1} < 1$
number of terms, $n = 20$

= $a (1 - r^n)/(1 - r)$
= $1000(0.98)^{40}(1.0075)^{-1} [1 - (0.98/1.0075)^{20}]/[1 - (0.98/1.0075)]$
= 6889.11

10.   E

Since each colleague only pays 1/5 of his or her dessert, each has an incentive to order dessert, since 1/5 the cost of a dessert is less than each diner's perceived value. Thus, five desserts will be ordered.

11.   C

The expression for the government expenditure multiplier is
$$\frac{dY}{dG} = \frac{1}{1 - C_Y(1-T') - NX_Y},$$
where C_Y is the marginal propensity to consume,
        T' is the marginal tax rate, and
        NX_Y is the income derivative of net exports.
In the problem, $C_Y = 0.7$, $T' = 0$, and $NX_Y = -0.1$.
Therefore the multiplier is 2.5 .

12.   C

$$98\, S_{\overline{3n|}} + 98\, S_{\overline{2n|}} = 8000$$
$$\frac{(1+i)^{3n} - 1}{i} + \frac{(1+i)^{2n} - 1}{i} = 81.63$$
$$(1+i)^n = 2$$
$$\frac{8-1}{i} + \frac{4-1}{i} = 81.63$$
$$\frac{10}{i} = 81.63$$
$$i = 12.25\%$$

13.   A

$$3600 = 2(100)(18) .$$

14. A

Because firms in the industry are making negative economic profits—i.e., losses—and because in perfectly competitive markets firms are price takers and therefore can neither control input or output prices, some firms will exit this industry, reducing supply and raising price.

15. A

By selling bonds, the central bank will reduce bank reserves, thus decreasing the money supply.

16. B

$$2Ia_{\overline{60}|\,0.744} = 2\left[\frac{\ddot{a}_{\overline{60}|\,0.744} - 60v^{60}}{0.744}\right] = 2729.7$$

17. E

Let I equal the interest rate used for discounting. The expected net present value of investing in shop X = 0.60 * (–300 + 120/I) + 0.40 * (–300 + 40/I) = –300 + 88/I. This expression is set equal to 800. Thus, I = 0.08.
The expected net present value of investing in shop Y
= 0.50 * (–200 + 100/0.08) + 0.50 * (–200 + 50/0.08) = 737.5 .

18. D

Advertising is not likely to prevent entry. As demand increases, market niches open up for competitors.

19. A

When the period is short-run, firms will adjust the quantity produced rather than the price of the output since price changes take time to affect consumer behavior.

20. C

Dollar weighted return K:
$I = 125 - 100 - 2x + x = 25 - x$

$$i = \frac{25 - x}{100 - x\left(\frac{1}{2}\right) + 2x\left(\frac{1}{4}\right)} = (25 - x)/100; \ (1 + i) = (125 - x)/100$$

Time weighted return L:
$(1 + i) = 125/100 \cdot 105.8/(125 - x) = 132.25/(125 - x) = (125 - x)/100$
$$(125 - x)^2 = 13{,}225$$
$$\therefore x = 10$$
$$i = (25 - x)/100 = 15\%$$

21. B

The equilibrium market price and quantity are 80 and 20, respectively. The marginal cost function is the derivative of the TVC function: $MC = 76 + 2q$. For the competitive firm, $P = MC$, $80 = 76 + 2q$, $q = 2$.

22. D

$r_{equity} = 0.035 + 1.2(0.144 - 0.035) = 0.1658$
$r_{debt} = 0.035 + 0.2(0.144 - 0.035) = 0.0568$
$r_{assets} = (0.0568)(200/500) + (0.1658)(300/500) = 0.1222$

23. B

$$\Delta e_{nom} = \Delta p^f - \Delta p = 3\% - 5\% = -2\%$$

$$\text{expected } e_{nom} = 2.00(1 - 0.02) = 1.96$$

24. A

$$100 + 200\ v^n + 300\ v^{2n} = 600\ v^{10}$$
$$100 + 151.882 + 173.01$$
$$= 424.89 = 0.708 = v^{10} \Rightarrow i = 3.5\%$$

25. E

In order to solve for the price of a call option, first the price of a put option must be determined and then the put-call parity formula is used.

Price of put option: $[(0.5 \times 0) + (0.5 \times 10)] / 1.04 = 5/1.04 = 4.81$

Price of call option
= Price of put option + current stock price – present value of exercise price
Price of call option = $4.81 + 45 - 40/1.04 = 11.35$

26. E

The y-intercept will increase because more y can now be purchased for all levels of x. The slope will not change because the relative price of x in terms of y remains constant.

27. A

$3,000/9.65 = 310,881$ is the capital required at age 65 to provide the monthly retirement benefit. $N = 12 \times 25 = 300$; $i = 8\%$; $FV = 310,881$ and $PMT = 324.73$.

28.   A

$$\left(1+i\right)^{10-n} = e^{\int_n^{10} \frac{1}{8+t}\,dt} = e^{\ln(8+t)\big|_n^{10}} = \frac{18}{(8+n)}$$

$$\therefore 20{,}000 = \int_0^{10}\left(8k+t\cdot k\right)\cdot\left(1+i\right)^{10-t}\,dt = \int_0^{10} k\cdot\left(8+t\right)\cdot\frac{18}{8+t}\,dt$$

$$= 18k\cdot t\big|_0^{10} = 180k \Rightarrow k = \frac{20{,}000}{180} = 111$$

29.   B

For an inferior good, the increase in income would lead to a decrease in the quantity of X purchased. The price decrease could either increase or decrease the quantity of X purchased depending on whether the good was Giffen or not. However, as long as the income effect dominated, the quantity of X purchased would decline regardless of the direction of the price impact. Thus, the good must be inferior but does not necessarily have to be Giffen.

30.   C

Let p = percent invested in Stock X . Portfolio return = 12% = 10%(p) + 20% (1 – p) = 20% – 10% (p) $\therefore$ p = 80% in Stock X .

Let p = correlation between the returns on Stocks X and Y . Portfolio variance = Z^2 = $(0.8)^2$ $(Z)^2$ + $(0.2)^2(1.5Z)^2$ + 2(0.8)(0.2) $\cdot$ p $\cdot$ (Z)(1.5Z) = $0.64Z^2$ + $0.09Z^2$ + $0.48Z^2 \cdot$ p $\therefore$ p = 0.27/0.48 = 56.25% .

31. D

This is not a particularly hard question if you know which purchase formula to use for bond Y (in this case, the base price formula is best)

Let C = redemption value of bond X = maturity value of bond Y

Bond X
G_1 = base amount of bond = Fr/i = 1031.25

$K_1 = 381.50 = C\, v^n$ (C, i, and n are all unknown)

Bond Y
$647.80 = C\, v^{n/2}$

Taking the ratio of the last two equations, we get:

$381.50/647.80 = v^n / v^{n/2} \rightarrow v^n = 0.3468224$ and C = 1100

Thus,

$P_1 = G_1 + (C - G_1)\, v^n = 1031.25 + (1100 - 1031.25)(0.3468224) = 1055.09$

32. B

The marginal revenue function for the monopolist is: $MR = 10 - 2Q$. Equating MR and MC yields Q of 2 and a price of 8 – the monopolist's solution. As for the competitive solution, just equate MC = Price. This yields a quantity of 2.5 and a price of 7.5 .

33. C

In a semi-strong efficient market all information about the company should be reflected in its stock price right away. Thus, since the announcement suggests that the company stock is now worth less, the price should fall right away.

34. C

By definition, GDP is the sum of consumption (C), investment (I), government purchases (G), and net exports (NX) . In this case $C + I + G + NX = 4.5 + 2.1 + 3.1 + 0.2 = 9.9$.

35. E

$\text{Principal} = 2000$

$\text{Annual interest} = 2000\left[(1.02)^4 - 1\right] = 164.86$

$\text{Total Annual Interest} = 164.86(10) = 1648.60$

$\text{Interest on Annual interest} = 164.86\left[(1.0225)^4 - 1\right] = 15.35$

$\text{Total interest on Annual interest} = 15.35(Is)_{\overline{9|}} = 15.35\left[\dfrac{\ddot{s}_{\overline{9|}} - 9}{0.07}\right] = 836.8$

$\text{Total} = 2000 + 1648.60 + 836.89 = 4485.49$

36. C

Beta of Jill's portfolio is $(2/3)*0.9 + (1/3)*1.2 = 1$, same as the market portfolio. Thus, its expected risk premium $= 1*(14.4\% - 6\%) = 8.4\%$.

37.   D

The company's forecasted dividends and prices grow as follows:

	Year 1	Year 2	Year 3
Dividend	10	10.50	11.03
Price	525	551.25	578.81

Calculate the expected rate of return:

From year 0 to year 1: $\dfrac{10+(525-500)}{500}=0.07$

From year 1 to year 2: $\dfrac{10.50+(551.25-525)}{525}=0.07$

From year 2 to year 3: $\dfrac{11.03+(578.81-551.25)}{551.25}=0.07$

So they all earn the same rate of return.

38.   B

With identical firms, entry will ensure that firms operate at the minimum of their AC curves, which implies that equilibrium price will equal AC and economic profits will be zero. Therefore, I and II are true. At the minimum of AC, MC=AC, which is not the minimum point of MC. Therefore, III is false.

39.   D

The increase in government purchases shifts the IS curve to the right, and the increase in the money supply shifts LM to the right. These shifts unambiguously lead to an increase in output, but the effect on interest rates could be either positive or negative.

40.   E

$$1.28 = (p)\left(\frac{X}{100}\right)(50)\left(\frac{1}{1.04}\right)$$

$$p = \text{probability}$$

$$4 = 10(1-p) - X(p)$$

$$pX = \frac{1.28(100)(1.04)}{50} = 2.6624$$

$$4 = 10 - 10p - 2.6624$$

$$10p = 3.3376$$

$$p = \frac{1}{3}$$

$$\frac{1}{3}X = 2.6624$$

$$X = 8$$

41.   B

With respect to X, if the compensated demand curve is flatter than the uncompensated curve, it must be that the income effect works in the opposite direction of the substitution effect; therefore the good is inferior. With respect to Y, since the slope of the uncompensated curve is positive, it must be a Giffen good, and therefore inferior.

42.	D

$(X-Y)/n = 1000$ $1000n = X-Y$
$(n-2)/Sn(X-Y) = 800$ $(n-2)/Sn(1000n) = 800$
$(n^2 - 2n)/Sn = 0.8$

n	$n^2 - 2n$	Sn	$(n^2 - 2n)Sn$
3	3	6	0.5
4	8	10	0.8

$n = 4$
$X - Y = 4000$
$1 - (Y/X)^{0.25} = 0.33125$ $(Y/X)^{0.25} = 0.66875$ $Y/X = 0.2$ $Y = 0.2X$ $X - 0.2x = 4000$
$0.8X = 4000$
$X = 5000$

43.	C

This question draws upon several key valuation principles. The Dividend Growth Model for stock valuation is used to estimate the cost of equity. A basic understanding of how bonds are valued is necessary to arrive at the cost of debt. Although calculations could be performed for an assumed face value, the astute student will note that because the bond sells at par, its yield to maturity must equal the coupon rate of 8% . Thus we have,

$R_E = D_1/P_0 + g = 7.5\% + 3\% = 10.5\%$, $R_D = 8\%$
$WACC = 0.70(10.5) + 0.30(8)(1 - 0.40) = 7.35 + 2.16 = 8.79\%$.

44.	D

According to rational expectations, unemployment will equal the natural rate whenever actual and expected inflation are equal. Deviations from the natural rate are caused by differences between expected and actual inflation.

45.   C

Under the constant percentage method,

annual depreciation expense for year k is
$D_k = d\, B_{k-1} = dC(1-d)^{k-1} = 0.2(20{,}000)(0.8)^{k-1} = 4000(0.8)^{k-1}$

The accumulated value of the 15 annual values of D_k is

av   = $D_{15} + D_{14}(1.06) + D_{13}(1.06)^2 + ... D_1(1.06)^{14}$
       = $4000\,[(0.8)^{14} + (0.8)^{13}(1.06) + (0.8)^{12}(1.06)^2 + ... + (1.06)^{14}]$

This is a geometric series with   first term, a = $4000(0.8)^{14}$
                                        common ratio, r = $(0.8)^{-1}(1.06) = 1.325 > 1$
                                        number of terms, n = 15

av   = $4000(0.8)^{14}\,[(1.325)^{15} - 1]\,/\,[1.325 - 1] = 36{,}328.83$

46.   C

If they don't specialize, then it takes Smith 30 hours and Jones 38 hours to handle their two cases each. But if they specialize along the lines of comparative advantage, then Smith works 28 hours on two criminal cases, and Jones works 36 hours on two divorce cases, for only 64 hours—a savings of 4 hours.

47.   D

$$-4000 + 2000v + 4000v^2 = 2000 + 4000v - xv^2$$
$$\left(\frac{4000 + x}{1.21}\right) = 6000 + \frac{2000}{1.1}$$
$$x = 5460$$

48. B

        Return on Equity (ROE) $= 150/1000 = 15\%$
        Dividends/Earnings $= 45/150 = 30\%$

        Thus the plowback ratio $= 1 - 30\% = 70\%$

        Dividend growth rate $g = 70\% \; x \; 15\% = 10.5\%$

        Market Capitalization Rate = Expected Dividend Yield + Dividend Growth Rate
        15.5% = Expected Dividend Yield + 10.5%
        Expected Dividend Yield = 5%

49. E

        Item II is true since economic rents are "profits that more than cover the opportunity cost of capital."

        Item III is true above, and it follows from the Marvin Enterprise example in the text.

50. B

$$\frac{600}{(6000+7000)/2} = 9.2\%$$