ECO 1192 B

MT2 ANSWERS

Q1. Answer is D.

Q2. Answer is E.

Q3. Answer is C.

Q4. Answer is B.

Q5. Answer is D.

Q6.
- Initial investment or, First cost = \$10,000
- Project return is provided in the form of an annuity, $A = \$3{,}000$
- Project life, $N = 5$ yrs.
- Interest rate, $i = 10\% = 0.1$

  Present Worth (PW) of benefits = ?

- Hence, the appropriate factor to use is the series present worth factor $(P|A, i, N)$

$$\therefore (P|A, 0.1, 5) = \frac{(1+i)^N - 1}{i\,(1+i)^N}$$

$$= \frac{(1+0.1)^5 - 1}{0.1\,(1+0.1)^5} = 3.7908$$

Thus, Project Benefit in PW $= A \cdot (P|A, i, N)$

$= 3000 \times (P|A, 0.1, 5)$

$= 3000 \times 3.7908$

$= \$11,372$

Q7. Answer is D. Project cost is already stated in the question in PW, which is \$10,000.

Q8.
- Initial investment or, First cost = \$50,000
- Annual maintenance cost, $A = 4000$
- Project life, $N = 15$
- $MARR = 10\% = 0.1$

Annual worth of the project, $AW = ?$

- So, the appropriate factor to use is the capital recovery factor $(A|P, i, N)$

$$\therefore (A|P, 0{\cdot}1, 15) = \frac{i\,(1+i)^N}{(1+i)^N - 1}$$

$$= \frac{0{\cdot}1\,(1+0{\cdot}1)^{15}}{(1+0{\cdot}1)^{15} - 1} = 0{\cdot}1315$$

Therefore, Project's $AW = P \cdot (A|P, i, N) + A$

$= 50000 \times 0{\cdot}1315 + 4000$

$= 10,574$ in absolute terms

or, ~~$~~10,574

Q9. • Note that annual savings from both projects are identical : $S_1 = \$60$ ml
$S_2 = \$70$ ml

• We need to find the PW of these savings

$\therefore$ PW of total savings $= \dfrac{60}{(1+i)^1} + \dfrac{70}{(1+i)^2}$

$= \dfrac{60}{(1{\cdot}1)^1} + \dfrac{70}{(1{\cdot}1)^2}$

where $i = 10\% = 0{\cdot}1$

$= \$112{\cdot}39$ ml.

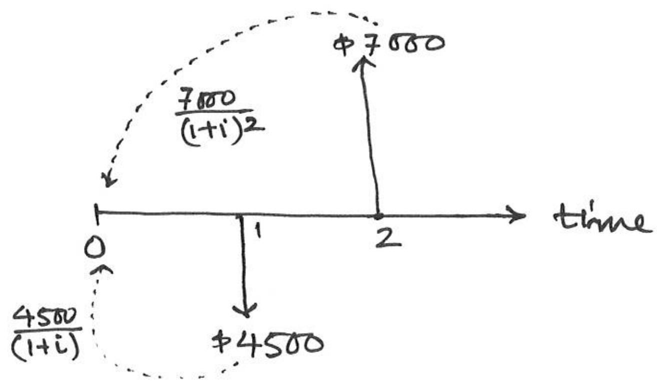
• We need to compare this PW of total savings with the two first costs (or, initial investment) options.

• Since the first project yields a positive PW, the answer is E.

Q10. Answer is D.

Q11. Answer is A.

Q12. Given



What is the rate of return (i.e. IRR)?

- Here, PW of disbursment $D_0 = \dfrac{4500}{(1+i)}$

  & PW of receipt $R_0 = \dfrac{7000}{(1+i)^2}$

  where, $i = IRR$

- By definition of IRR: $D_0 = R_0$

$$\Rightarrow \frac{4500}{(1+i)} = \frac{7000}{(1+i)^2}$$

$$\Rightarrow 45 = \frac{70}{(1+i)} \quad \left[\text{multiply both sides by } \frac{(1+i)}{100}\right]$$

$$\Rightarrow 9 = \frac{14}{(1+i)} \quad \left[\text{Divide both sides by } 5\right]$$

$$\Rightarrow 9 + 9i = 14$$

$$\Rightarrow 9i = 5 \qquad \therefore i = 0.555 \approx 56\%$$

Q13. Answer is A. Why?

- Note that IRR for individual projects (let's call them i_1, i_2, i_3, i_4 & i_5) are at least or greater than the MARR (=16%) for all projects except for project 2.

  $\therefore$ $i_N \geq$ MARR for $N = 1, 3, 4, 5$ and $i_2 <$ MARR

  In other words, project 2 is not considered.

- Now let's define incremental IRR between two projects N and M as $\hat{i}_{N,m}$

  Thus, incremental IRR between project 1 & 3 is given by, $\hat{i}_{1,3} = 17\%$.

  Similarly, $\hat{i}_{3,4} = 13\%$ and $\hat{i}_{3,5} = 17\%$.

- We start from project 1. First we compare incremtal investment between project 1 & 3.

  Since, $\hat{i}_{1,3} = 17\% >$ MARR $= 16\%$.

  we choose project 3 over project 1.

- Then we compare between project 3 and 4.

  Since, $\hat{i}_{3,4} = 13\% <$ MARR $= 16\%$.

  we <u>do not</u> opt for project 4 & retain project 3.

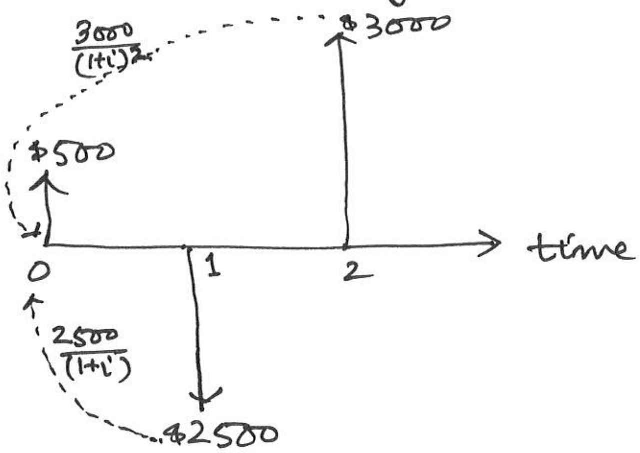
- Finally, we compare between project 3 & 5.

  Since, $\hat{i}_{3,5} = 17\% >$ MARR $= 16\%$.

  we choose project 5.

Q14. Answer is D.

Q15. The cash-flow diagram looks like the following



What is IRR?

- Here, PW of disbursement $= \dfrac{2500}{(1+i)}$

  PW of receipts $= 500 + \dfrac{3000}{(1+i)^2}$

  where, $i = IRR$

- By definition of IRR:

$$\frac{2500}{(1+i)} = 500 + \frac{3000}{(1+i)^2}$$

$$\Rightarrow \frac{5}{(1+i)} = 1 + \frac{6}{(1+i)^2} \quad \left[\text{Divide both sides by } 500\right]$$

$$\Rightarrow \frac{5}{(1+i)} = \frac{(1+i)^2 + 6}{(1+i)^2}$$

$$\Rightarrow \quad 5 = \frac{(1+i)^2+6}{(1+i)} \quad \left[\begin{array}{c}\text{Multiply both} \\ \text{sides by } (1+i)\end{array}\right]$$

$$\Rightarrow 5(1+i) = (1+i)^2 + 6$$

$$\Rightarrow 5 + 5i = 1 + 2i + i^2 + 6$$

$$\Rightarrow i^2 + 2i + 7 = 5 + 5i$$

$$\Rightarrow i^2 + 2i - 5i + 7 - 5 = 0$$

$$\Rightarrow i^2 - 3i + 2 = 0$$

$$\Rightarrow i^2 - 2i - i + 2 = 0$$

$$\Rightarrow i(i-2) - 1(i-2) = 0$$

$$\Rightarrow (i-2)(i-1) = 0$$

Hence $i = 2 = 200\%$ and $i = 1 = 100\%$

Q16. Answer is A.

Q17. Given information:

Current Asset = \$9000
Long-term Asset = \$11000
Current Liabilities = \$7000
Long-term Liabilities = \$8000
Owener's Equity = \$5000

Therefore, Total Asset = Current Asset + Long-term Asset

$$= 9000 + 11000$$

$$= 20000$$

and, Equity Ratio $= \dfrac{\text{Total Owner's Equity}}{\text{Total Asset}}$

$$= \frac{5000}{20000} = 0.25$$

Q18.

- Purchase price, $P = \$2000$

  Salvage value, $S = \$500$

  Useful life, $N = 3$ yrs.

- So, straight-line depreciation is:

$$D_{SL}(n) = \frac{P-S}{N} = \frac{2000-500}{3}$$

$$= \$500$$

- Hence, book value after 2 yrs is:

$$BV_{SL}(2) = P - n\left[\frac{P-S}{N}\right]$$

$$= P - n \cdot D_{SL}(n)$$

$$= 2000 - 2 \times 500 \quad [\text{where } n = 2 \text{ yrs}]$$

$$= \underline{\$1,000}$$

Q19. • Purchase price, $P = \$150,000$
Salvage value, $S = \$16,100$
Service life, $n = 10$ yrs.

• So, declining-balance depreciation rate is:

$$d = 1 - \sqrt[n]{\left(\frac{S}{P}\right)}$$

$$= 1 - \left(\frac{S}{P}\right)^{1/n}$$

$$= 1 - \left(\frac{16100}{150000}\right)^{1/10}$$

$$= 1 - \left(\frac{16100}{150000}\right)^{0.1}$$

$$= 0.20003$$

$\therefore d \approx 20\%$

Q20. • Note that the value of the car declines by 5% every year. That is, the car depreciates by equal proportion every year. Thus, the appropriate depreciation model to use is the declining-balance depreciation model.

Hence, $d = 5\% = 0.05$

Purchase price, $P = \$9520$

Salvage value, $S = \$6000$

Useful life, $n = ?$

Therefore, $d = 1 - \left(\frac{S}{P}\right)^{1/n}$

$$\Rightarrow 0.05 = 1 - \left(\frac{6000}{9520}\right)^{1/n}$$

$$\Rightarrow \left(\frac{6000}{9520}\right)^{1/n} = 1 - 0.05$$

$$\Rightarrow (0.630252)^{1/n} = 0.95$$

$$\Rightarrow \ln\left[(0.630252)^{1/n}\right] = \ln(0.95)$$

$$\Rightarrow \frac{1}{n}\ln(0.630252) = \ln(0.95)$$

$$\Rightarrow \frac{1}{n}(-0.46164) = (-0.05129)$$

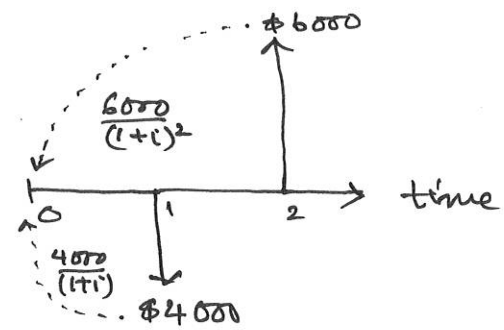
$$\Rightarrow \frac{1}{n} = \left(\frac{-0.05129}{-0.46164}\right)$$

$$\Rightarrow n = \frac{0.46164}{0.05129}$$

$$\therefore n \approx 9 \text{ yrs.}$$

Q21. Answer is E.

Q22. The cash-flow diagram looks like the following



What is IRR?

- Here, PW of disbursement $= \dfrac{4000}{(1+i)}$

  PW of receipt $= \dfrac{6000}{(1+i)^2}$

  where $i = IRR$

- By definition of IRR: $\dfrac{4000}{(1+i)} = \dfrac{6000}{(1+i)^2}$

$$\Rightarrow 4 = \frac{6}{(1+i)}$$

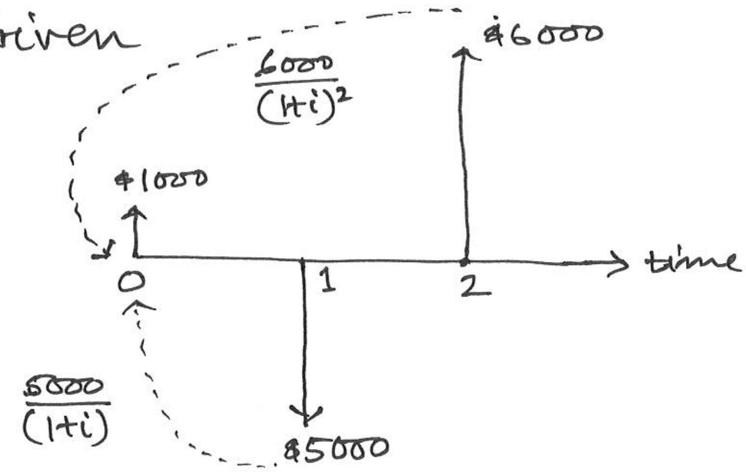
$$\Rightarrow 2(1+i) = 3$$

$$\Rightarrow 1+i = \frac{3}{2}$$

$$\Rightarrow 1+i = 1.5$$

$$\therefore i = 0.5 = 50\%.$$

Q23. Given

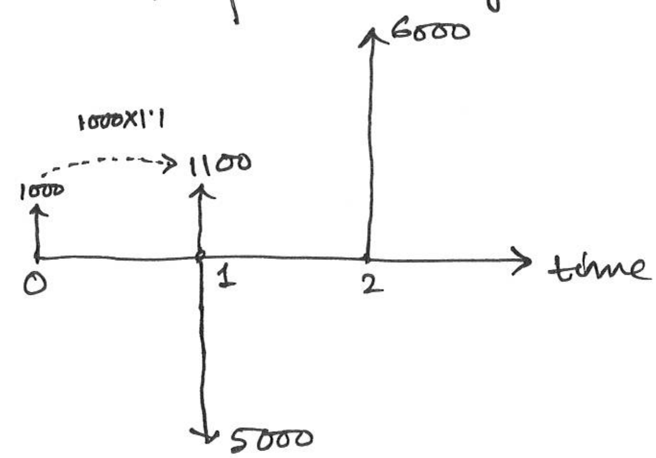


- Note that, in order to find the ERR, we need to transform the cash-flow diagram by investing the free-cash (i.e. \$1000 given as disbursement at the beginning) at MARR (=10%).

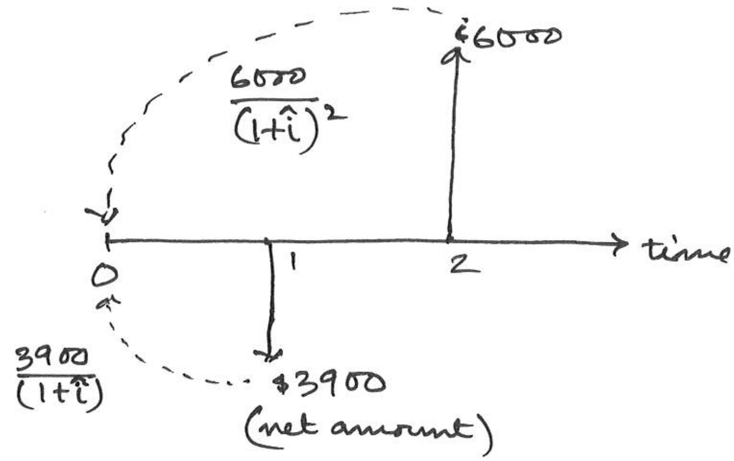
- So, when \$1000 is invested at MARR for 1 year, it earns: $1000\,(1+10\%)$

$$= 1000\,(1+0.1)$$
$$= 1000 \times 1.1$$
$$= \$1100$$

- Thus, the cash-flow diagram can be transformed as,



OR,



where $\hat{i} = \text{ERR}$.

- So, PW of disbursement $= \dfrac{3900}{(1+\hat{i})}$

  PW of receipt $= \dfrac{6000}{(1+\hat{i})^2}$

- By definition of ERR:

$$\frac{3900}{(1+\hat{i})} = \frac{6000}{(1+\hat{i})^2}$$

$$\Rightarrow \quad 39 = \frac{60}{(1+\hat{i})}$$

$$\Rightarrow \quad 39 + 39\hat{i} = 60$$

$$\Rightarrow \quad 39\hat{i} = 60 - 39$$

$$\Rightarrow \quad \hat{i} = (21/39) = 0{\cdot}5384$$

$$\therefore \quad \hat{i} \approx 54\%.$$

Q24. Answer is C.

Q25. • Since the company is Canadian, the "Half-Year Rule" applies.

- Purchase price, $P = \$20{,}000$
- $CCA = 20\% = 0.2$
- Tax rate, $t = 40\% = 0.4$

Hence, allowed capital cost $= \frac{1}{2}(P \times CCA)$

$$= \frac{1}{2}(20000 \times 0.2)$$

$$= \frac{1}{2} \times 4000$$

$$= \$2000$$

Thus, tax savings in the first year:

$$\$2000 \times t$$

$$= 2000 \times 0.4$$

$$= \$800$$

Q 26. Answer is B.

Q27. • There are 5 projects: A, B, C, D, E.

- Since, PW calculation for all projects use the same methodology, only PW of project A (call it PW_A) calculation is shown here. Repeat the same methodology for the remaining projects.

- So, $$PW_A = -100 + \frac{200}{(1+i)} + \frac{300}{(1+i)^2} + \frac{400}{(1+i)^3}$$

$$= -100 + \frac{200}{1.1} + \frac{300}{1.1^2} + \frac{400}{1.1^3}$$

where $i = MARR = 10\%$.

$$= \$630.28$$

- Similarly, varify that:

$PW_B = \$1192.79$

$PW_C = \$71.30$

$PW_D = \$275.66$

$PW_E = \$349.29$

- So, project B should be chosen.

Q28. Answer is C.

Q29. Answer is C.

Q30. Answer is D.