COMPOUND INTEREST & DEPRECIATION

Recall for Compound Interest:

$$Final\ amount = P\left(1 + \frac{r}{100}\right)^n$$

$$Interest\ earned = Final\ amount - principal$$

Task 1 – Calculate the final amount in the account, given no money is withdrawn and a deposit of:

1) £600 at 5% per year for 3 years   **£694.58**
2) £1,000 at 4% per year for 2 years   **£1,081.60**
3) £2,500 at 6% per year for 4 years   **£3,156.19**
4) £800 at 3.5% per year for 5 years   **£950.15**
5) £3,200 at 2% per year for 3 years   **£3,395.87**

Task 2 – Calculate the interest earned on an investment of:

6) £1,200 at 3% per year for 4 years   **£150.62**
7) £900 at 4.5% per year for 2 years   **£82.82**
8) £4,000 at 5% per year for 3 years   **£630.50**
9) £2,700 at 6.5% per year for 5 years   **£999.23**
10) £1,500 at 7% per year for 1 year   **£105**

Task 3

11) Liam invests £1,500 in a bank account paying 5% compound interest per year. What is Liam's total balance after 3 years?

Total balance $= 1500\left(1 + \frac{5}{100}\right)^3 = \mathbf{£1736.44}$

12) A business deposits £10,000 into a fixed account at 4% compound interest per year for 5 years. What is the total amount in the account after 5 years?

Total amount $= 10000\left(1 + \frac{4}{100}\right)^5 = \mathbf{£12,166.53}$

13) Maria invests £2,000 at 3% compound interest for 6 years. How much interest will she earn in total?

Total amount $= 2000\left(1 + \frac{3}{100}\right)^6 = £2388.10$
Interest earned = £2388.10 – £2000 = **£388.10**

14) A company sets aside £5,500 in a reserve account earning 6% compound interest per year. After 2 years, they withdraw half the total balance. How much is withdrawn?

Total amount $= 5500\left(1 + \frac{6}{100}\right)^2 = £6179.80$
Amount withdrawn = £6179.80 ÷ 2 = **£3089.90**

15) A student places £750 in an account that earns 4.5% compound interest per year for the first 2 years and 6% compound interest for the third year. How much money is in the account at the end of 3 years?

After 2 years $= 750\left(1 + \frac{4.5}{100}\right)^2 = £819.02$

After 3 years $= 819.02\left(1 + \frac{6}{100}\right)^1 = \mathbf{£868.16}$

16) £3,000 is invested in a bank at 3.5% compound interest per year. If no money is withdrawn, how many years until the account has a balance of at least £3950?

Trial and error:

$$3000\left(1 + \frac{3.5}{100}\right)^6 = £3,687.77$$
$$3000\left(1 + \frac{3.5}{100}\right)^7 = £3,816.84$$
$$3000\left(1 + \frac{3.5}{100}\right)^8 = £3,950.43$$

$$\mathbf{\textit{8 years}}$$

17) A charity invests £15,000 at r% compound interest per year. After 3 years, they have a total amount of £17,117.49 in the account. Work out the interest rate earned to 1 decimal place.

$$15000\left(1 + \frac{r}{100}\right)^3 = 17117.49$$

$$\left(1 + \frac{r}{100}\right)^3 = \frac{17117.49}{15000}$$

$$1 + \frac{r}{100} = \sqrt[3]{\frac{17117.49}{15000}}$$

$$1 + \frac{r}{100} = 1.044999\ldots$$

$$\frac{r}{100} = 0.044999\ldots$$

$$r = 4.4999\ldots$$

$$Interest\ rate = \mathbf{4.5}\%\ (\mathbf{1\ dp})$$

18) Jack is deciding between two offers at different banks.

Bank A: Open a savings, deposit £3000 and earn 7% interest for the first 4 years.

Bank B: Open a savings, deposit £3000 and earn 6% simple interest for the first 4 years. An additional payout of £250 will be given at the end of the 4 years.

Which offer should Jack choose? You must show all your working.

Bank A: $3000\left(1 + \frac{7}{100}\right)^4 = £\mathbf{3,932.39}$

Bank B: $3000 \times 0.06 \times 4 = £720$
$3000 + 720 + 250 = £\mathbf{3,970}$

Jack should choose Bank B.

19) £2,200 is saved in an account that pays 6% compound interest per year, compounded monthly. How much interest is earned after 4 months?

Monthly interest = 6% ÷ 12 = 0.5%

Final amount $= 2200\left(1 + \frac{0.5}{100}\right)^4 = £2244.33$

Interest earned $= £2244.33 - £2200 = £\mathbf{44.33}$

Recall for Depreciation:
$$Value\ after\ depreciation = P\left(1 - \frac{r}{100}\right)^n$$

Task 4

20) A car is bought for £18,000. It depreciates at 12% per year. What is its value after 3 years?

Value $= 18000\left(1 - \frac{12}{100}\right)^3 = £\mathbf{12,266.50}$

21) A laptop costs £1,200 and loses value at 20% per year. How much will it be worth after 4 years?

Value $= 1200\left(1 - \frac{20}{100}\right)^4 = £\mathbf{491.52}$

22) A motorbike costs £6,500 and depreciates at 8% per year. Find its value after 5 years.

Value $= 6500\left(1 - \frac{8}{100}\right)^5 = £\mathbf{4284.03}$

23) A machine costs £25,000 and depreciates at 15% per year. Calculate its value after 2 years.

Value $= 25000\left(1 - \frac{15}{100}\right)^2 = £\mathbf{18,062.50}$

24) A delivery van is bought for £28,000. After 5 years, it is worth £12,335. Find the annual depreciation rate to 1 decimal place.

$$28000\left(1 - \frac{r}{100}\right)^5 = 12335$$

$$\left(1 - \frac{r}{100}\right)^5 = \frac{12335}{28000}$$

$$1 - \frac{r}{100} = \sqrt[5]{\frac{12335}{28000}}$$

$$1 - \frac{r}{100} = 0.848782\ldots$$

$$\frac{r}{100} = 0.151217\ldots$$

$$r = \mathbf{15.1}\%\ (\mathbf{1\ dp})$$

25) A camera is bought for £2,000 and depreciates at a rate of 14% per year. How many years will it take for its value to fall below £1,000?

Trial and error:

$$2000\left(1 - \frac{14}{100}\right)^3 = £1,272.11$$

$$2000\left(1 - \frac{14}{100}\right)^4 = £1,094.02$$

$$2000\left(1 - \frac{14}{100}\right)^5 = £940.85$$

$$\mathbf{5\ years}$$