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Money.

Main idea is when do I get to spend the money.

Compound Interest.

P = present value

F = future value

t = time

i = interest = always a decimal.

$$F = P(1+i)^t \quad \text{or} \quad P = \frac{F}{(1+i)^t}$$

£5,000 is invested for 2 years at 2% AER. Find value at end of 2nd year.

AER = annual equivalent rate = save.

APR = annual percentage rate = borrow

Nominal rate = rate given in year but question per month.

$P = 5000 \quad t = 2 \quad i = 0.02$

$$F = P(1+i)^t$$

$$= 5000\,(1.02)^2$$

A sum of money is borrowed for 3 years at 8.9% APR. €2,540 is paid back at end of 3^{rd} year. How much was borrowed?

$P = ?$ $F = 2540$ $t = 3$ $i = 0.089$

$$P = \frac{F}{(1+i)^t} = \frac{2540}{(1.089)^3}$$

$$= €1966.75$$

€500 is invested for 2 years at 0.5% year 1 and 0.6% year 2. Find interest gained over 2 years.

Year 1: $P = 500$ $t = 1$ $i = 0.005$

$$F = P(1+i)^t$$

$$= 500(1.005)$$

$$= 502.5$$

Year 2:

$$F = 502.5(1.006)$$

$$= €505.515 = €505.52$$

Interest €505.52 − €500 = €5.52.

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€ 6,000 is borrowed for 2 years at 9% APR. € 2000 is paid back at end of first year. How much is owed at end of year 2.

$P = 6000 \qquad i = 0.09$

Year 1.

$F = P(1+i)$

$= 6000(1.09) = €6540$

$€6540 - €2000 = €4540$

Year 2:

$F = 4540(1.09)$

$= €4,948.60$

€ 3,500 is borrowed for 2 years at 8% APR. It is paid back in two equal instalements. Find instalements at end of each year.

$P = 3500 \qquad i = 0.08$

Year 1.

$F = P(1+i)$

$= 3500(1.08)$

$= 3780$

Instalement $= x$

Year 2:

$P = 3780 - x \qquad i = 0.08$

$F = (3780 - x)(1.08) = x$

$4082.4 - 1.08x = x$

$4082.4 = 2.08x$

$€1962.69 = x$

€2,100 is invested for 1 year at r%. It amounts to €2,180 find r to 1 decimal place.

$P = 2100 \quad t = 1 \quad r = ? \quad F = 2180$

$$F = P(1+r)^t$$

$$2180 = 2100(1+r)$$

$$\frac{2180}{2100} = 1+r$$

$$1.038 = 1+r$$

$$r = 0.038$$

$$= 3.8\%$$

The APR is 12% find the monthly interest rate.

Let $P = 100 \quad F = 112 \quad t = 12$

$$F = P(1+r)^t$$

$$112 = 100(1+r)^{12}$$

$$1.12 = (1+r)^{12}$$

$$1+r = \sqrt[12]{1.12}$$

$$1+r = 1.00948$$

$$r = 0.00948$$

$$r = 0.948$$

$$r = 0.95\%$$

How will it take an investment to double if compounded annually at 6.5% AER.

$r = 0.065 \quad P = 100 \quad F = 200$

$$F = P(1+r)^t$$

$$200 = 100(1.065)^t$$

$$2 = (1.065)^t$$

$\log_{1.065} 2 = t$

$t = 11.006$

Ans $t = 12$ years

Continuous Growth

$F = Pe^{rt}$ $P = \frac{F}{e^{rt}}$

Find the value of €3,500 invested for 2 years compounded continuously at a nominal rate of 3.5%.

$P = 3500$ $t = 2$ $r = 0.035$

$F = Pe^{rt}$

$= 3500e^{0.035(2)}$

$= €3753.78$

Compounded annually

$F = P(1+r)^t$

$= 3500(1.035)^2 = €3749.29$

What sum of money compounded continuous at AER of 2% is worth €653.40 after 3 years?

$r = 0.02$ $t = 3$ $F = 653.40$

$P = \frac{F}{e^{rt}}$

$= \frac{653.40}{e^{0.06}} = €615.35$

€500 invested for 3 years at r% compounded continuously grows to €512.50 find r to 1 decimal place.

$P = 500 \qquad F = 512.50 \qquad r = ? \qquad t = 3$

$$P = Fe^{rt}$$

$$\frac{512.50}{500} = e^{3r}$$

$$\log_e \frac{512.50}{500} = 3r$$

$$\ln \frac{512.50}{500} = 3r$$

$$3r = 0.02$$

$$r = 0.00823$$

$$= 0.8\%$$

Depreciation.

$F = P(1-r)^t$ = reducing balance = compound

$F = Pe^{-rt}$ = continuous.

A car cost €25,000 and depreciate at a compound rate of 18% annually. Find value after 3 years.

$P = 25000 \qquad t = 3 \qquad r = 0.18$

$$F = P(1-r)^t$$

$$= 25000(0.82)^3$$

$$= €13,784.20$$

$\boxed{F = NBV = \text{net book value.}}$

A tractor is worth €154,000 after 3 years at 16% nominal rate of depreciation. Find value when new if compounded continuously.

$F = 154000 \qquad t = 3 \qquad r = 0.16$

$$P = \frac{F}{e^{-rt}}$$

$$= \frac{154000}{e^{(-0.48)}} = €\,248,875.46$$