

Annuity.

While contributing:

$$F = a \frac{I^n - 1}{i}$$

$$\Sigma \text{ contrs} = an$$

$$F - an = a \left[\frac{I^n - 1}{i} - \frac{ni}{i} \right] = a \left[\frac{\cos - \sin}{i} \right]$$

$$= na \left[\frac{I^n - 1}{ni} - 1 \right]$$

$$= na \left[\frac{\cos}{\sin} - 1 \right]$$

$F - an$ is now taxable.

So are all the earnings of F during annuity pd.

n based on life expectancy, say 15

$F \frac{i}{1 - I^{-15}}$ is a

Divide in 2 parts

1

P = Peak value of pension fund, age puts begin

c = contribn, annual

n = no. of yrs. contribns are made

i = i.r.

l = life after retirement, from mortality tables

a = annuity pmt., annual.

$$P = c \frac{I^n - 1}{i}$$

Normally c comes from employer, is not taxed. Then, entire annuity is taxable when rec'd. Then:

$$a = P \frac{i}{1 - I^{-l}} = c \frac{I^n - 1}{1 - I^{-l}} \neq \frac{\cancel{I^n - 1}}{\cancel{1 - I^{-l}}} \cdot \frac{\cancel{I^{n+l} - I^l}}{\cancel{I^n - 1}}$$

If you die early, & a survivor gets the annuity, (over)

Sometimes c comes from employee, was already taxed.

Then ~~the~~ P has a component part of P is returned tax free. Call that F . $F = nc$. The part of the annuity paid by F is still taxable for the interest, but not the recovery of F .

b = ~~ann~~ pmt. from F

$$b = F \frac{i}{1 - I^{-l}}$$

or a lump, taxes are probly due (unlike cap. gains)

Taxable portion of b is F in yr. one.
 Let t be ~~current yr.~~ ~~counting from retirement.~~
 remaining yrs. to expected death.

$b I^{-t}$ is recovery of F , tax free.

$b(1 - I^{-t})$ is int., taxable.

If you ~~do~~ die early, any lump distribn. of
 unused

FICA e.g.

Age 18 - 65 = 47 yrs.

After 1990, ~~15.3~~ ^{15.3} 9% of salary up to max of (say) ~~40,000~~
43,800 (the 1977 cap)

<u>yr</u>	<u>Rate</u>	<u>Cap</u>	<u>Unit</u>	<u>2 x Unit</u>
1987	17.15	43,800	3,131.70	6,263.40

To simplify, assume for future:

Rate = 15.3%

Cap = 45,000

Unit = 6885/yr.

accum. @ 10%

$$FV = \frac{1.1^{47} - 1}{.10} = 872.7$$

$$872.7 \times 6,263 = \$5,461,179$$

Benefits: 15 yrs @ 15,000

$$PV \# \text{ at age } 65 = 15,000 \times 7.606 = 114,091$$

$$PV \text{ at age } 18 = 114,091 / 88.2 = 1,293$$