People buy insurance to protect their families from financial distress if they pass. Some can be used as a savings plan.

Business Mathematics
Class notes
Life Insurance (section 13.5)

We buy life insurance to pay for our funeral or to pay other bills when we pass away. Some forms of life insurance build up a cash retirement value. Life insurance can also be bought by businesses to help the business cope with the loss of an owner.

Life insurance rates can be based on your sex, age, smoking status, and if you have dangerous hobbies like skydiving.

Insurance Types that do *not* accumulate cash value:

Term insurance is the cheapest type of life insurance but it does *not* build up cash value for retirement. It only pays out when a person dies. This insurance is usually renewable until a certain age, like 70, when the insured can no longer renew it.

Individuals can buy a **level-premium term** policy. Here, the **premium** (annual cost) remains constant for a period of time, such as 10 or 20 years. Thereafter, premiums increase rapidly.

Decreasing term insurance has fixed premiums. However, the amount of insurance (**death benefit** or **payout**) decreases periodically. This kind of insurance may pay $160,000 if you die at age 28, but only $140,000 if you die at 32. The decrease continues until, at some age, the payout would be nothing.

Insurance Types that *do* accumulate cash value:

Whole life (aka **straight life**, **ordinary life**, or **permanent**) provides a death benefit and a savings plan. The insured commonly pays a constant premium until death or retirement, whichever occurs first. If the person dies, a death benefit is paid. If *not*, the insured may choose to convert the accumulated cash value to a retirement benefit.

Universal life provides the protection of term insurance plus a tax-deferred way to accumulate assets. For example, universal life can help a family obtain more insurance when your children are at home and then help accumulate savings later after the children are grown.

Variable life allows policyholders to make choices among investment options (money market funds, bonds, stocks, or a combination), placing the risk with the policyholder.

Limited-payment life insurance is similar to whole life insurance but a higher premium is paid for a limited time like 20 years (called **20-pay life**). This is appropriate for people like actors or athletes whose income is likely to be high for several years and then decline.

Endowment policies are the most expensive type. They accumulate cash value more rapidly than the other types. These guarantee a fixed payment to a given individual, whether or *not* the insured lives. These are taken out to ensure money for a grandchild's education, for example, but due to the high premium, they are one of the least popular types of insurance.

Finding annual premiums:

Calculation of premiums is based on several factors, including age, sex, interest rates, and other factors. Women tend to live a few years longer than men, so pay a lower premium usually. **When looking women up on the premium table below, subtract 5 years from the age of the woman.** (Incidentally, women are more likely to become disabled and so pay higher rates for disability insurance.)

Sample Annual Premium Rates* per $1,000 of Life Insurance

Age (of Man)*	10-year Level Premium Term	Whole Life	Universal Life	20-Pay Life
20	1.60	4.07	3.48	12.30
21	1.65	4.26	3.85	12.95
22	1.69	4.37	4.10	13.72
23	1.73	4.45	4.56	14.28
24	1.78	4.68	4.80	15.95
25	1.82	5.06	5.11	16.60
30	1.89	5.66	6.08	18.78
35	2.01	7.68	7.45	21.60
40	2.56	12.67 #1	10.62	24.26
45	3.45	19.86	15.24	28.16
50	5.63	26.23	21.46	32.59 #2
55	8.12	31.75	28.38	38.63
60	14.08	38.42	36.72	45.74

* For women, subtract 5 years from her age before entering table. For example, the rates for a 30-year-old woman are found in the row for the age 25.

We use this formula for finding an annual premium.

Annual premium = Number of thousands x Rate per $1,000

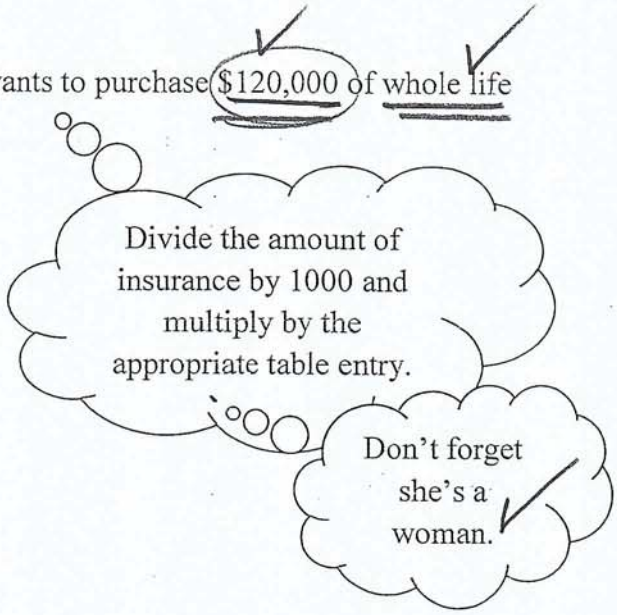
of insurance bought

Divide the face value of insurance by 1000 and multiply by the appropriate table entry.

expl 1: Martha Jackson, a woman, is 45 years old. She wants to purchase $120,000 of whole life insurance. How much will her annual premium be?

$$\frac{120{,}000}{1000} * 12.67$$

Ann. prem = $1520.40 / year.



expl 2: Bo Jackson, a man who is age 50, needs $400,000 in 20-pay life insurance. How much will his annual premium be?

$$\text{ann prem} = \frac{400{,}000}{1000} * 32.59$$

$$= \$13036 / \text{year}$$

Paying Premiums Semiannually, Quarterly, or Monthly:

Insurance companies expect to be paid once a year. If you cannot afford that much at once, they will take payment twice a year (semiannually), quarterly (four times a year), or monthly. However, they charge a slight uptick in price. Here is a table with multipliers that will find the periodic payment needed to pay on these more frequent schedules.

These are slightly more than 1/2, 1/4, and 1/12.

Premium Factors

Mode of Payment	Premium Factor
Semiannually	0.51
Quarterly	0.26
Monthly	0.0908

expl 3: Find the payments Martha from example 1 would pay if she decided to pay semiannually, quarterly, or monthly.

annprem = $1520.40

Start with her annual premium and multiply by these factors.

Semiannually: 1520.40 * 0.51
≈ $775.40 paid twice a year.

quarterly: 1520.40 * 0.26
≈ $395.30 paid every 3 months

Monthly: 1520.40 * 0.0908
≈ $138.05 paid every month

(a total of $1656.60)