Bob "loans" $4,000 to Calvin but gets his interest up front so really only gives Calvin $3,700.

Business Mathematics
Class notes
Simple Discount Notes (section 9.3)

For a **simple discount note** (or **interest-in-advance note**), interest is figured (with banker's or ordinary interest) and deducted from the amount of the loan *before* the borrower receives the money. We have some new and repurposed terminology.

Definition: Proceeds: the loan amount, or how much the borrower receives.

Definition: Discount: the interest that is paid.

Definition: Face value: the **maturity value** of the loan which is the amount that must be repaid.

In previous sections, the face value and maturity value were *not* the same.

Here is a nice graphic from the book that helps make sense of the terminology.

Simple Interest versus Simple Discount Notes

Type of Note	Loan Amount		Interest		Repayment Amount
Simple interest	Face value (Principal)	+	Interest	=	Maturity value
Simple discount	Proceeds	+	Discount (Interest)	=	Face value (Maturity value)

Let's jump right in with some formulas. First, we have the basics.

$B = M \times D \times T$

B = **bank discount** (interest amount)
M = **Face** (or **Maturity**) **Value**
D = **discount rate** (decimal form)
T = **time** money is invested (years)

Why does this look so familiar?

1

Similar to the old $M = P + I$ formula for "how much you repay is equal to how much you borrowed plus interest", we have the following which simply uses the new variables and terminology.

$$M = P + B \quad \text{or} \quad P = M - B$$

B = **bank discount** (interest, from above)
M = **Face** or **Maturity Value** (what is repaid)
P = **Proceeds** (amount borrower receives)

expl 1a: Find the discount and the proceeds for the following simple discount note.

Face Value: $12,500
Discount Rate: 11%
Time (days): 150

Use your formulas, keeping the variables straight.

expl 1b: Now write a sentence or two explaining what the heck we just found.

2

Solving for Discount Rate (D) and Time (T):

If we take our basic formula $B = M \times D \times T$ and solve it for T or D, we get the following.

$$T = \frac{B}{MD} \quad \text{and} \quad D = \frac{B}{MT}$$

B = bank discount (interest amount)
M = Face (or **Maturity**) **Value**
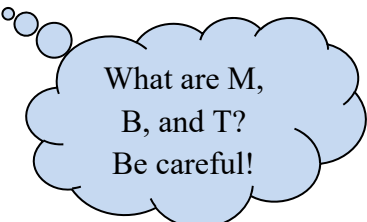**D = discount rate** (decimal form)
T = time money is invested (years)

expl 2: Jessica signed a $12,200 note at a discount rate of 11%. She was told the interest would be $931.94. Find the length of the loan in days.
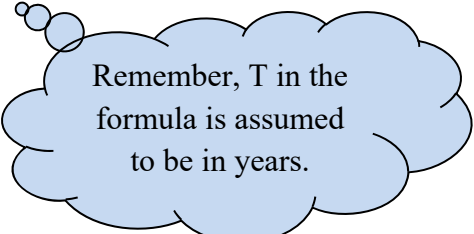
What are M, B, and D?

We are *not* done when we use the formula above. Why *not*?
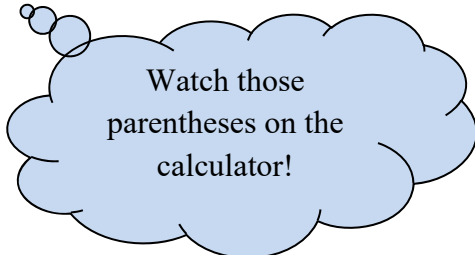
Don't round 'til the end!

expl 3: Kim Lee wants to open a store. He signed a 200-day simple discount note with a face value of $125,000 and proceeds of $118,195. Find the discount rate. Round to the nearest tenth of a percent.

What are M, B, and T? Be careful!

Remember, T in the formula is assumed to be in years.

Watch those parentheses on the calculator!

Solving for Face Value (M):

Sometimes we will be asked to find the face value (M) of a loan but *not* given the interest amount (B). In this case, we will use this formula.

$$M = \frac{P}{1 - DT}$$

P = **proceeds** (amount borrower receives)
M = **Face** (or **Maturity**) **Value**
D = **discount rate** (decimal form)
T = **time** money is invested (years)

expl 4a: A regional manager at Trugreen, Inc. borrows $98,300 for equipment. The simple discount note has a 9.25% rate and matures in 150 days. Find the face value of the note.

Calculator:
Enter 98300 / (1 − .0925 × 150 / 360)
OR
Enter 1 − .0925 × 150 / 360 *and then*
98300 / ANS to avoid a rounding error.

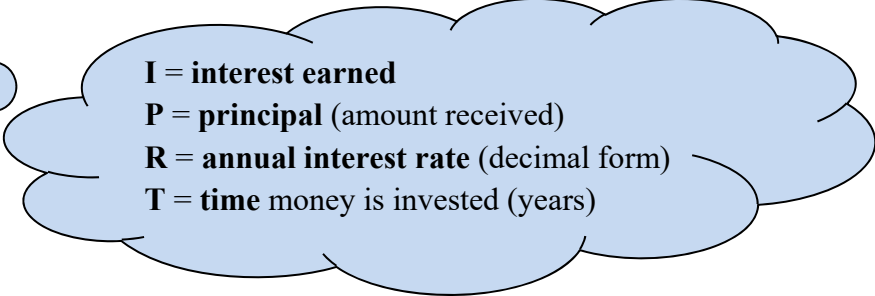ANS is the second function of the (−) key in the number pad. It means "previous answer".

expl 4b: What is the meaning of this "face value"?

Effective Rate (aka **Annual Percentage Rate** or **APR):**

How do we compare two loans with different terms? The federal Truth in Lending Act requires that interest rates be given in a form that is easily comparable. The **effective rate of interest** is the interest rate that is calculated based on the actual amount of money received by the borrower. It is also called the **true rate**. We are basically finding the simple *interest* rate based on how much the borrower *receives*.

To find the effective rate for a loan, we will use the old formula $I = P \times R \times T$ but solved for R. That is,
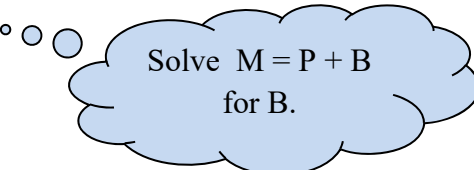
$$R = \frac{I}{PT}$$

I = **interest earned**
P = **principal** (amount received)
R = **annual interest rate** (decimal form)
T = **time** money is invested (years)

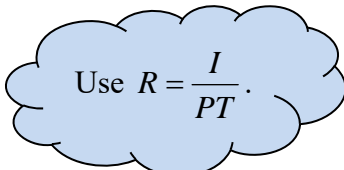We may need to calculate I of course. Remember this is B in simple discount notes.

expl 5: To remodel the restaurant, Two Bro's Pizza signs a 300-day note with proceeds of $63,159.72 and a face value of $68,000. Find the following.

a.) Find the discount.

Solve $M = P + B$ for B.

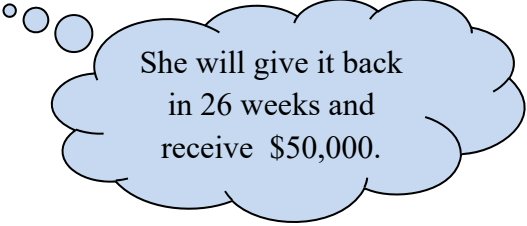b.) Find the APR. Round to the nearest tenth of a percent.

Use $R = \frac{I}{PT}$.

Treasury Bills:

Treasury bills are how the government borrows money from wealthy people, governments, and, if you're lucky, your grandma. You can buy a treasury bill or **T-bill** to loan the US government money for up to a year. You would buy, say, a $100 T-bill which would be worth $100 in six months. It would only cost you, say, $98. The difference is the interest you earn (or the bank discount).

You want to keep in mind that there are 52 weeks in a year.

expl 6: Nina Horn buys a $50,000 T-bill at a 5.8% discount rate for 26 weeks. Find the following.
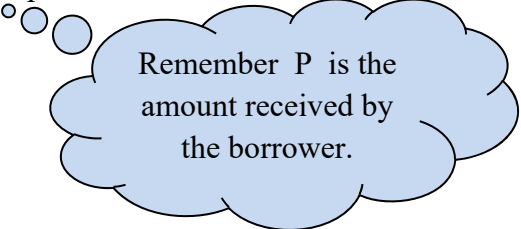
a.) Find the purchase price of the T-bill.

She will give it back in 26 weeks and receive $50,000.

b.) Find the maturity value of the T-bill.

c.) Find the interest earned.

d.) Find the effective rate of interest to the nearest hundredth of a percent.

Remember P is the amount received by the borrower.