

Simple interest

EXERCISE 2: USING TIME TO CALCULATE INTEREST

► Find the interest for given principle, rate, and time.

	Principal	x	Rate	x	Time (Years)	=	Interest
1.	\$3,800		8%		3		_____
2.	\$2,370		11.5%		4		_____
3.	\$1,560		9.25%		2.5		_____
4.	\$4,500		12.75%		1.25		_____
5.	\$6,200		6.5%		3		_____
6.	\$560		10%		0.5		_____
7.	\$920		11.5%		1.5		_____

► The following are single payment loans. That is, the amount is to be repaid all at once. Find the interest and amount to be repaid. Set your decimal selector at 2.

	Principal	Rate	Time	Interest	Repayment
8.	\$550	7%	1 yr	_____	_____
9.	\$1,200	11%	2 yr	_____	_____
10.	\$3,350	10.5%	3 yr	_____	_____
11.	\$5,890	12.5%	2.5 yr	_____	_____
12.	\$3,125	9.5%	0.5 yr	_____	_____
13.	\$6,000	10%	5-yr	_____	_____
14.	\$8,500	8%	3.5 yr	_____	_____
15.	\$4,790	12.5%	2 yr	_____	_____

Simple interest for less than a year is sometimes based on a "banker's year," which is 360 days. When using the banker's year, simple interest can be calculated for any number of days by using the following formula:

$$\text{Simple interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time (in days)}}{\text{Days per year (360)}}$$

DEMONSTRATION EXAMPLE

\$5,000 is loaned at 7% interest for 85 days.

$$\begin{aligned} \text{Simple interest} &= \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{\text{Days per year}} \\ &= \frac{5,000 \times 7\% \times 85}{360} \\ &= 82.64 \end{aligned}$$

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EXERCISE 3: USING THE BANKER'S YEAR

► Use the banker's year (360 days) for the following simple interest problems.

	Principal	Rate	Time	Interest	Repayment
1.	\$650.00	9.00%	90	\$_____	\$_____
2.	\$935.00	9.25%	120	\$_____	\$_____
3.	\$1,026.49	9.50%	210	\$_____	\$_____
4.	\$1,225.80	8.75%	195	\$_____	\$_____
5.	\$1,986.31	9.75%	320	\$_____	\$_____
6.	\$2,493.67	10.25%	119 <i>.55</i>	\$_____	\$_____
7.	\$3,500.00	9.33%	350 <i>.472</i>	\$_____	\$_____
8.	\$5,150.0	9.50%	305 <i>.2072</i>	\$_____	\$_____
9.	\$6,230.00	10.50%	211 <i>.5861</i>	\$_____	\$_____
10.	\$8,437.12	11.00%	343 <i>.4727</i>	\$_____	\$_____
11.	\$9,680.95	9 3/4%	150	\$_____	\$_____
12.	\$7,083.00	9 1/4%	110	\$_____	\$_____
13.	\$1,540.00	9 3/4%	240	\$_____	\$_____
14.	\$862.49	11 2/3%	30	\$_____	\$_____
15.	\$500.00	10 1/2%	90	\$_____	\$_____

Example 180 day loan = $\frac{180}{360} = .5 \text{ YR}$
 USE $P * R * t$

WORKING WITH COMPOUND INTEREST

When you invest money in a bank, the interest is added to the principal on a regular basis. Additional interest is then based on this new principal. This method is called "compound interest." The amount of your interest does not remain the same—as it would for simple interest—but keeps increasing because the principal keeps increasing.

To work with compound interest, you will need to use exponents. An exponent is simply a raised number that tells you to multiply a base number by itself so many times.

DEMONSTRATION EXAMPLE 1

Find (a) 2^5 ; (b) 1.07^9

$$(a) 2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$$

On your business calculator, this repetition can be done by repeated use of the \square or \square key or by using the constant function. Check your calculator manual or ask your instructor for assistance.

$$(b) 1.07^9 = 1.8386$$

Suppose you invest \$100 for 2 years at 8% interest compounded annually. The interest for one year is \$8. The new principal at the end of the year is the principal plus the interest, which is \$108. The interest for the second year is $108 \times 0.08 = 8.64$, and the new principal is $108 + 8.64 = 116.64$.

Since interest is computed as a percent of principal, you can think of the principal as 100% and add the interest rate. Then the amount to be paid can be found in one step. For example, if you invest \$500 for one year at 9%, you can find the total amount of principal plus interest as follows:

$$500 \times 1.09 = 545$$

When interest is compounded every year, each new principal is multiplied again by 100% plus the interest rate.

DEMONSTRATION EXAMPLE 2

Find the growth of \$1,000 invested at 9% compounded annually for 5 years.

$$1,000 (1.09)^5 = 1,000 \times 1.5386 = 1,538.62$$

\$1,000 invested for 5 years at 9% interest will grow to \$1,538.62.

EXERCISE 1: DETERMINING COMPOUND INTEREST

► Find the amount of each number raised to the given exponent. Give each answer to four decimal places.

- | | |
|-------------------------|--------------------------|
| 1. $5^{10} =$ _____ | 2. $4.8^6 =$ _____ |
| 3. $1.57^{20} =$ _____ | 4. $1.095^{25} =$ _____ |
| 5. $2.3^9 =$ _____ | 6. $1.02^{30} =$ _____ |
| 7. $1.075^{15} =$ _____ | 8. $6.8^5 =$ _____ |
| 9. $1.06^{10} =$ _____ | 10. $1.055^{10} =$ _____ |

► Find the amount each investment compounded yearly at the given rate and after the given number of years.

	P Investment	R Rate	T Time (in Years)	Amount
11.	\$100	8%	4	_____
12.	\$1,000	8.5%	7	_____
13.	\$385	10%	10	_____
14.	\$760.50	6.5%	20	_____
15.	\$1,340	9.25%	8	_____
16.	\$3,590.40	11.5%	15	_____
17.	\$100	10.5%	7	_____
18.	\$1,000	5.5%	13	_____
19.	\$5,690	14.6%	6	_____
20.	\$2,287.61	9.17%	11	_____
21.	\$10,000	6%	12	_____
22.	\$6,812	7.55%	10	_____
23.	\$3,014.50	8.47%	20	_____
24.	\$100	10.5%	14	_____
25.	\$800	5.5%	26	_____

$$P * (1 + R)^t$$

$$\text{Ex: } 100 * (1 + .08)^4$$

1. DETERMINING COMPOUND INTEREST

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____

EXERCISE 1: DETERMINING TOTAL INTEREST FOR INSTALLMENT PURCHASES

► Find the total interest for each amount. Remember, there are 12 months in a year. (15 months ÷ 12 months = 1.25 years)

- | | |
|-------------------------------------|-----------------------------------|
| 1. \$900 at 10% for 1 year. | 2. \$2,000 at 8% for 1.5 years. |
| _____ | _____ |
| 3. \$2,800 at 9.5% for 2 years. | 4. \$5,000 at 11% for 3.5 years. |
| _____ | _____ |
| 5. \$3,796 at 12.25% for 2.5 years. | 6. \$6,440 at 9.5% for 21 months. |
| _____ | _____ |
| 7. \$870 at 10.5% for 15 months. | 8. \$670 at 11.25% for 6 months. |
| _____ | _____ |
| 9. \$450 at 8.5% for 3 months. | 10. \$1,235 at 10% for 2 years. |
| _____ | _____ |

Once you know the total amount of interest for a loan, you add this amount to the principal and divide the total by the number of months to find the monthly payment.

DEMONSTRATION EXAMPLE 2

Find the monthly payment on an installment loan of \$2,400 at 9.5% to be paid over 2.5 years. First find the total amount of interest.

$$\begin{array}{rclclcl} \text{Interest} & = & \text{Principal} & \times & \text{Rate} & \times & \text{Time} \\ & = & 2,400 & \times & 9.5\% & \times & 2.5 = 570 \end{array}$$

Find the total to be paid and divide to find the monthly payments.

To find the number of months: $2.5 \times 12 = 30$

Keystrokes: 2,400 $\boxed{+}$ 570 $\boxed{=}$ $\boxed{\div}$ 30

Display: 2,400 2,400 570 2970 2,970 99

The monthly payment is \$99.

1. DETERMINING TOTAL INTEREST FOR INSTALLMENT PURCHASES

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

2. DETERMINING MONTHLY PAYMENT

EXERCISE 2: DETERMINING MONTHLY PAYMENT

Find the total interest and monthly payment for each.

1. _____
Interest Amount _____
Monthly Payment _____
2. _____
Interest Amount _____
Monthly Payment _____
3. _____
Interest Amount _____
Monthly Payment _____
4. _____
Interest Amount _____
Monthly Payment _____
5. _____
Interest Amount _____
Monthly Payment _____
6. _____
Interest Amount _____
Monthly Payment _____
7. _____
Interest Amount _____
Monthly Payment _____
8. _____
Interest Amount _____
Monthly Payment _____
9. _____
Interest Amount _____
Monthly Payment _____
10. _____
Interest Amount _____
Monthly Payment _____

1. \$500 at 10% for 1 year. Interest amount _____ Monthly payment _____
2. \$1,250 at 11% for 2 years. Interest amount _____ Monthly payment _____
3. \$2,500 at 11.5% for 2.5 years. Interest amount _____ Monthly payment _____
4. \$4,650 at 9.5% for 3.5 years. Interest amount _____ Monthly payment _____
5. \$895 at 8.5% for 15 months. Interest amount _____ Monthly payment _____
6. \$1,368 at 11.25% for 21 months. Interest amount _____ Monthly payment _____
7. \$1,768 at 12% for 30 months. Interest amount _____ Monthly payment _____
8. \$6,000 at 12.6% for 3.5 years. Interest amount _____ Monthly payment _____
9. \$505 at 8.6% for 6 months. Interest amount _____ Monthly payment _____
10. \$423.50 at 10.25% for 9 months. Interest amount _____ Monthly payment _____

As you pay off a loan or make installment purchases, the principal decreases. Suppose you borrow \$1,000 for a year with an interest charge of \$100. This appears to be 10% interest. But that interest is for the use of the entire principal for one year. If you make monthly payments to repay the loan, then you do not have the use of the \$1,000 for the whole year. So the \$100 really represents an interest rate higher than 10%. Lending institutions are generally required to tell borrowers the true annual interest rate. This rate can be calculated using the following formula.

$$\text{True annual interest rate} = \frac{24 \times \text{Interest amount}}{\text{Principal} \times (\text{Number of payments} + 1)}$$

DEMONSTRATION EXAMPLE 3

Find the true annual interest rate on \$2,400 borrowed for 2.5 years at 10.5%.

$$\text{Interest amount} = 2,400 \times 10.5\% \times 2.5 = 630$$

$$\text{Number of payments} = 2.5 \times 12 = 30$$

$$\text{True annual interest rate} = \frac{24 \times 630}{2,400 \times 31}$$

Enter:	24	<input type="text" value="x"/>	630	<input type="text" value="÷"/>	2,400	<input type="text" value="÷"/>	31	<input type="text" value="%"/>
Display:	24	24	630	15,120	2,400	6.3	31	20.32

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EXERCISE 3: FINDING THE TRUE ANNUAL INTEREST RATE

► Find the interest amount, the monthly payment, and the true annual interest rate for each of the following:

- Principal \$500 Interest rate 9%
Total number of payments 12 (360 days)
Interest amount _____
Monthly payment _____
Annual interest rate _____
- Principal \$675 Interest rate 10%
Total number of payments 15 (450 days)
Interest amount _____
Monthly payment _____
Annual interest rate _____
- Principal \$850 Interest rate 11%
Total number of payments 18 (540 days)
Interest amount _____
Monthly payment _____
Annual interest rate _____
- Principal \$1,000 Interest rate 9%
Total number of payments 24 (720 days)
Interest amount _____
Monthly payment _____
Annual interest rate _____
- Principal \$1,500 Interest rate 8%
Total number of payments 30 (900 days)
Interest amount _____
Monthly payment _____
Annual interest rate _____
- Principal \$1,350 Interest rate 10%
Total number of payments 14 (420 days)
Interest amount _____
Monthly payment _____
Annual interest rate _____

3. FINDING THE TRUE ANNUAL INTEREST RATE

1.

Interest Amount

Monthly Payment

Annual Interest Rate
2.

Interest Amount

Monthly Payment

Annual Interest Rate
3.

Interest Amount

Monthly Payment

Annual Interest Rate
4.

Interest Amount

Monthly Payment

Annual Interest Rate
5.

Interest Amount

Monthly Payment

Annual Interest Rate
6.

Interest Amount

Monthly Payment

Annual Interest Rate