

1. Express each of the following as a percent:

a.  $\frac{3}{5}$

$$\frac{3}{5} = 0.60 = 60\%$$

b. 2.45

$$2.45 = 245\%$$

2. A coat was originally sold for \$300 and is now being advertised as “20% off” (meaning its price has been reduced by 20%). What is the coat’s current price?

$$\text{Price Reduction} = 0.20 * 300 = \$60.$$

$$\text{Current Price} = \$300 - \$60 = \$240.$$

3. If a person’s salary increases from \$36,000 to \$40,320, by what percent has the salary increased?

$$\text{Salary Increase} = \$40,320 - \$36,000 = \$4320.$$

$$\text{Percent Increase} = \frac{\$4320}{\$36,000} = 0.12 = 12\%$$

4. If you borrow \$3000 at a simple interest rate of 4.25%, how much will you owe after 2 years?

$$A = P(1 + rt)$$

$$A = 3000(1 + 0.0425 * 2)$$

$$= \$3,255$$

5. If you borrow \$3000 at an annual interest rate of 4.25% compounded quarterly, how much will you owe after 2 years?

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

$$A = 3000 \left(1 + \frac{0.0425}{4}\right)^{(4*2)}$$

$$= \$3,264.69$$

6. Cindy wants to buy a painting priced at \$5500. Because she is unable to pay the full price right away, the gallery agrees to let her pay on installment. She pays \$1000 down and another \$140 each month for the next 3 years. What is the finance charge for this purchase?

$$\text{Total Amount Paid} = 1000 + 140 * 12 * 3 = \$6,040.$$

$$\text{Finance Charge} = \$6,040 - \$5,500 = \$540.$$

7. Suppose you receive a credit card statement for the time period from December 1 - December 31. The unpaid balance on December 1 was \$900. A payment of \$400 was recorded on December 10. A \$150 purchase was made on December 15 and a \$100 purchase was made on December 24. The monthly rate for this card is 1.2% and interest is computed using the unpaid balance method. What is the total balance owed for this card on December 31?

$$\text{Interest} = 0.012 * (900 - 400) = \$6.$$

$$\text{Balance Owed} = 500 + 250 + 6 = \$756.$$

8. For the credit card statement in question 7, what would the total balance owed be on December 31 if the credit card company used the average daily balance method for computing interest?

$$\begin{array}{r}
 \$900 \text{ for } 9 \text{ days} = 8100 \\
 \$500 \text{ for } 5 \text{ days} = 2500 \\
 \$650 \text{ for } 9 \text{ days} = 5850 \\
 \$750 \text{ for } 8 \text{ days} = 6000 \\
 \hline
 \text{Total:} \qquad \qquad 22450
 \end{array}$$

$$\begin{aligned}
 \text{Average Daily Balance} &= \frac{22450}{31} = \$724.19 \\
 \text{Interest} &= 0.012 * 724.19 = \$8.69 \\
 \text{Balance Owed} &= 500 + 250 + 8.69 = \$758.69
 \end{aligned}$$

9. A young couple decides to buy a house. Their offer of \$200,000 is accepted by the seller. They pay a 25% down payment and get a 30-year mortgage at an annual interest rate of 5.75% for the remaining amount. How much is their monthly payment?

$$\begin{aligned}
 \text{Down Payment} &= 0.25 * 200000 = \$50,000. \\
 \text{Mortgage Amount} &= 200000 - 50000 = \$150,000. \\
 \text{From the mortgage table, we get } &\$5.84 \text{ for each } \$1000 \text{ borrowed.} \\
 \text{Monthly Payment} &= 5.84 * 150 = \$876.
 \end{aligned}$$

10. For the couple in question 9, complete the portion of their amortization table shown here:

Pmt. #	Unpaid Bal.	Monthly Pmt.	Monthly Int. Rate	Int. Paid	Princ. Paid
1	\$150,000	\$876	0.00471917	\$718.75	\$157.25
2	\$149,842.75	\$876	0.00471917	\$718	\$158

11. After each statement write “TRUE” or “FALSE” as appropriate. (Don’t just write “T” or “F”).

- (a) If you are borrowing money at a fixed annual interest rate, it is better for you if the interest is compounded daily than if it is compounded monthly.

FALSE. The amount will grow faster the more often it is compounded.  
This is bad if you are borrowing (good if you are saving).

- (b) An argument can be valid and have a conclusion that is false.

TRUE. If any of the premises are false, the conclusion can still be false even if it follows logically from the premises.

- (c) The only numeration system still being used today for any purpose is the base ten system.

FALSE. Roman numerals are still frequently used as are the binary, octal, and hexadecimal systems.

(d) The set  $\{2, 4, 6\}$  has 9 different subsets.

FALSE. This set has  $2^3 = 8$  different subsets.

12. After each statement write “TRUE” or “FALSE” as appropriate. (Don’t just write “T” or “F”).

(a)  $7 \in \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

TRUE. 7 is an element of the set.

(b)  $3 \notin \mathbb{N}$

FALSE. 3 is in the set of natural numbers.

(c)  $\{a, b, c\} \subsetneq \{a, b, c\}$

TRUE. A set cannot be a proper subset of itself.

(d)  $\emptyset \subset \{3, 5, 7\}$

TRUE. The empty set is a subset of every set.

13. Let  $U = \{a, b, c, d, e, f, g, h\}$ ,  $A = \{e, f, g\}$ ,  $B = \{c, d, e, f\}$ . Find  $(A \cap B) \cup B'$ .

$$\begin{aligned}(A \cap B) \cup B' &= \{e, f\} \cup \{a, b, g, h\} \\ &= \{a, b, e, f, g, h\}\end{aligned}$$

14. Suppose a travel company commissioned a survey that asked 500 people in the Midwest the following three questions and received the indicated answers (all respondents answered either yes or no):

Have you ever been to Disney Land?	Yes: 260
Have you ever been to the Alamo?	Yes: 80
Have you ever been in the St. Louis Arch?	Yes: 150

When publishing the results of this survey, the company notes that 200 of the respondents had not been to any of the three tourist sites. They also noted that 105 people had been to both Disney Land and the St. Louis Arch and 65 people had been to both the Alamo and the St. Louis Arch, and only 50 people had been to all three places.

Use a Venn Diagram to determine how many of the people surveyed had been to two of the tourist sites, but not all three.



$55 + 10 + 15 = 80$  people had been to exactly two of the sites.

15. Let the statements  $p, q,$  and  $r$  be defined as follows:

- $p$  : That dog can talk.
- $q$  : That dog is my spokesperson.
- $r$  : That dog does not have a job.

Write the following argument in words.

$$\begin{array}{l} p \rightarrow q \\ \sim q \rightarrow r \\ \sim r \\ \hline \therefore p \end{array}$$

If that dog can talk then it is my spokesperson.  
 If that dog is not my spokesperson then he has no job.  
 That dog has a job.  


---

 Therefore, that dog can talk.

(This argument is invalid by the way.)

16. Use a truth table to determine if the following argument is valid or invalid.

$$\begin{array}{l} p \\ q \rightarrow p \\ \hline \therefore q \end{array}$$

$p$	$q$	$q \rightarrow p$	$p \wedge (q \rightarrow p)$	$(p \wedge (q \rightarrow p)) \rightarrow q$
T	T	T	T	T
T	F	T	T	F
F	T	F	F	T
F	F	T	F	T

Because the conclusion does not always follow from the premises,  
 the argument is invalid.

17. Write each of the following as a Hindu-Arabic (base ten) numeral.

a. The Babylonian numeral  $\ll \vee \vee < \vee$

b. The Mayan numeral 

$$< < \vee \vee < \vee = 22 * 60 + 11 * 1 = 1331$$

$$\begin{array}{c} \hline \text{■} \\ \dots \\ \hline \end{array} = 5 * 360 + 8 * 1 = 1808$$

18. Convert the numeral  $3105_{\text{six}}$  to a numeral in base ten.

$$\begin{aligned} 3105_{\text{six}} &= 3 * 6^3 + 1 * 6^2 + 0 * 6^1 + 5 * 6^0 \\ &= 689 \end{aligned}$$

19. Convert the base ten numeral 236 to base four.

$$\begin{array}{r} 3 \\ 64 \overline{) 236} \\ \underline{192} \\ 44 \end{array} \quad \begin{array}{r} 2 \\ 16 \overline{) 44} \\ \underline{32} \\ 12 \end{array} \quad \begin{array}{r} 3 \\ 4 \overline{) 12} \\ \underline{12} \\ 0 \end{array}$$

$$\begin{aligned} 236 &= 3 * 64 + 2 * 16 + 3 * 4 + 0 * 1 \\ &= 3 * 4^3 + 2 * 4^2 + 3 * 4^1 + 0 * 4^0 \\ &= 3230_{\text{four}} \end{aligned}$$