OLIVER'S LEARNING

Basic Math Skills

Welcome to Basic Math Skills!

Most students find the math sections to be the most difficult. Basic Math Skills was designed to give you a refresher on the basics of math. There are lots of mathematical questions on the exam. To you, the student, this means that you need to know math!

We will cover the following topics:

Chapter 1: Addition

Adding is when you group things together. It helps you find out how many things you have. If you have 4 pencils and someone gives you 3 more, you will now have a total of 7 pencils calculated as 4 + 3 = 7. (+ is the arithmetic "sign" used when you add things together)
For larger numbers, it is easier if you put them under each other.

For example: if you have 102 of something (pennies) and someone gives you 405 more, you will have:

$$\begin{array}{r} 102 \\ +\underline{405} \\ 507 \end{array} \text{ pennies}$$

You start by adding the numbers on the right and work your way across, right to left. In our example, you first add 5 +2 = 7, then 0 + 0 = 0, then 4 + 1 = 5 to give you 507.

When you are adding, if each addition comes to more than 10, you must "carry" the left hand number and add it on to the next column.

Example:

$$\begin{array}{r} 369 \\ \underline{+782} \\ 1,151 \end{array}$$

It is common to put a comma (,) after every 3 numbers, starting from the right. In our example, you will first add 2 + 9 = 11, record the 1 and "carry" the 1 to the next column where you will now add 1 + 8 + 6 = 15, record the 5 and "carry" the 1, you will now add 1 + 7 + 3 = 11.

Practice Questions

1. 153 + 462 + 789 = ?

2. $$\begin{array}{r} 1004 \\ 3425 \\ \underline{9065} \\ ? \end{array}$$

3. 436 + 780 + 111 + 459 = ?

Chapter 2: Subtraction

Subtracting is when you take things away from a group. It helps you find out how many things you have left. If you have 8 pencils and you give someone 6 of them, you will now have a total of 2 pencils calculated as 8 - 6 = 2. "– "is the arithmetic "sign" when you subtract things from each other. For larger numbers, it is easier if you put them under each other.

For example: if you have 505 pennies and you give 301 of them to someone else, you will now have:

$$\begin{array}{r} 505 \\ -\underline{301} \\ 204 \end{array} \text{ pennies}$$

You start by subtracting the numbers on the right and work your way across, right to left. In our example you first subtract 5 - 1 = 4, then 0 - 0 = 0, then 5 - 3 = 2 to give you 204.

When you are subtracting, if each subtraction comes to less than 0:

Example:

$$\begin{array}{r} 612 \\ -\underline{498} \\ 114 \end{array}$$

You must "borrow" a 1 from the top number. In our example, 2 – 8 would = –6 because 8 is greater than 2. However, if you "borrow" 1 from the next number (the 1) and attached it to the 2, the 2 becomes a 12. The 1 therefore becomes a 0 (1 – 1 = 0). The 0 must "borrow" 1 from the next number (6) and when it is attached to the 0, the 0 becomes 10. Finally the 6 becomes a 5 (6 – 1 = 5). Therefore, our subtraction is 12 – 8 = 4, 10 – 9 = 1 and 5 – 4 = 1 to give us 114.

Practice Questions

1. 200 – 98 = ?

2. $$\begin{array}{r} 403 \\ -\underline{398} \\ ? \end{array}$$

3. $$\begin{array}{r} 683 \\ -342 \\ -\underline{24} \\ ? \end{array}$$

4. 15 people got on an elevator on the ground floor, 3 got off on the first floor, 6 got off on the second floor, how many were left on the elevator?

Chapter 3: Multiplication

Multiplication is another form of addition. For example, 6 x 4 (x is the arithmetic “sign” for multiplying). Using addition, this is 4 + 4 + 4 + 4 + 4 + 4 (6 times) = 24 or 6 + 6 + 6 + 6 (4 times) = 24. In other words, 6 x 4 is the same as 4 x 6.

You will notice that any number multiplied by 0, the answer is 0. Complete the rest of the table and check your answers. To understand basic math you must study the multiplication table and commit it to memory.

x	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0	0	0	0	0	0	0	0	0	0	0
1	0										
2	0										
3	0										
4	0										
5	0										
6	0										
7	0										
8	0										
9	0										
10	0										

For example, let’s multiply 43 x 56:

```
  43
x 56
2,408
```

When multiplying large numbers by large numbers, you must carry the next number, just as you did in addition. Start by multiplying 6 x 3 = 18, record the 8 and carry the 1. Then multiply 6 x 4 = 24 + the 1 that was carried now = 25. Write down 25, so you now have 258 in the first row of the calculation under the = sign or bar.

```
  43
x 56
258
```

Multiply the 5 x 3 = 15, write down the 5 under the second number of the 258 and carry the 1

```
   43
 x 56
  258
   5
```

Multiply the 5 x 4 = 20 + 1 that was carried and write down 21 next to the 5 in the second row.

```
   43
 x 56
  258
 215
```

Now add the columns in the first and second row.

```
   43
 x 56
  258
 215
2,408
```

The answer is 2,408.

Practice Questions

1. 322 x 678 = ?

2.
```
 6781
x 542
   ?
```

Chapter 4: Division

Division is the opposite of multiplication, so you must know multiplication to do division.

Here are some examples of the different symbols for division:

$\frac{300}{10}$ is the same as 300 ÷ 10.

Here is our first example: 2,106 ÷ 6 = 351

2,106 ÷ 6 and starting from left to right 6 goes into 21, 3 times (6 x 3 = 18) and a 3 is carried to the next number 0 making it 30. 6 goes into 30, 5 times (6 x 5 = 30). The last number is 6, and 6 goes into 6, 1 times (6 x 1 = 6) so the answer is 351. You can check your answer by multiplying 351 x 6 = 2,106.

In the example, 6 went into 2,106 evenly but sometimes there is a remainder. For example, 4,102 ÷ 5 = 820 and the 2 is the remainder. The answer could be written 820 R2 or as a decimal .4 (2 ÷ 5 = .4) *(decimals are discussed in more detail in a later chapter).* The answer can be checked by multiplying 820 x 5 and adding 2 for an answer of 4,102.

Practice Questions

1. 1,002 ÷ 8 = ?
2. 4,004 ÷ 4 = ?

Chapter 5: Symbols Used in Arithmetic

Sometimes other symbols are used in the calculations.

Adding and **subtracting** are always + and –.

For **multiplication**, the following symbols may be used:

- x
- Brackets around numbers.
  - For example: (43)(65) means 43 x 65.
  - Most times brackets are used in combination with + or –. For example (8 + 5)(6 – 3) means you should first add (8 + 5 = 13) and multiply that by (6 – 3 = 3) for an answer of 13 x 3 = 39. You should always do the calculation within the bracket first.
- *
  - For example 5*7 means 5 x 7 for an answer of 35.

For **division**, the following symbols may be used:

- ÷
- /
  - For example 18/3 means 18 ÷ 3 for an answer of 6.
- A line may be used as a division symbol
  - $\frac{4278}{3}$ means 4,278 ÷ 3 for an answer of 1,426.

Chapter 6: Fractions and Mixed Numbers

Fractions are used to represent parts of a whole. The fraction bar is the bar between the numbers on the top and bottom. For example: This fraction means 61 out of 82 or 61 divided by 82. $\frac{61}{82}$ or 61/82

The top number is called the numerator and the bottom number is the denominator. You would never have a 0 in the denominator. This type of fraction is undefined and the answer would be infinity.

Proper fractions have a numerator smaller than the denominator (e.g. 1/2 or 54/78). Improper fractions have numerators that are **bigger** than the denominator (e.g. 87/12 or 53/34).

A **mixed number** is a whole number paired with a proper fraction such as 4 2/5 or 7 1/8.

Reducing a Fraction

The fraction 5/10 has the same value as the fraction 1/2. The numerator and denominator were both reduced by dividing each by 5. A piece of string 5/10 inches long is the same length as one that is 1/2 inches long.

The fraction 40/60 has its nominator and denominator divisible by 20. When each is divided the fraction is reduced to 2/3 which is the same value. If the fraction 2/3 became 40/60, it would be said to have been augmented.

Addition of Fractions

In order to add fractions, they must have the same denominator. For example, it is easy to add 2/4 + 1/4 for an answer of 3/4. All you do is add the numerators (2 + 1 = 3).

When fractions do not have the same denominator you must multiply both the numerator and denominator by the same number for each fraction. This is more complicated.

Let’s do an example: Add 3/8 + 3/5 + 3/10.

You must make a common denominator of 40 because that is the lowest number each denominator is divisible into.

- For 3/8 you get 15/40. [40 ÷ 8 = 5, thus the numerator becomes 15 (3 x 5) and the numerator becomes 40 (8 x 5)].
- For 3/5 you get 24/40. [40 ÷ 5 = 8, thus the numerator becomes 24 (3 x 8) and the numerator becomes 40 (5 x 8)].
- For 3/10 you get 15/40. [40 ÷ 10 = 4, thus the numerator becomes 12 (3 x 4) and the numerator becomes 40 (10 x 4)].

The total is 15/40 + 24/40 + 12/40 = 51/40. As a mixed number, it is 1 11/40.

Subtraction of Fractions

Once again, you must augment the fractions to make the denominators the same and then subtract the numerators.

Here is an example: Subtract 26/8 – 12/16 – 1/32.

The lowest common denominator is 32.

- For 26/8 you get 104/32 [32 ÷ 8 = 4, thus the numerator becomes 104 (26 x 4) and the numerator becomes 32 (8 x 4)].
- For 12/16 you get 24/32 [32 ÷ 16 = 2, thus the numerator becomes 24 (12 x 2) and the numerator becomes 32 (16 x 2)].
- For 1/32, it remains as 1/32

The total is 104/32 – 24/32 – 1/32 = 79/32. As a mixed number, it is 2 15/32

Multiply Fractions

It is easier to multiply fractions because you do not need to find a common denominator. You simply multiply both the numerators and denominators straight across.

For example: 2/3 x 4/5 = [2 x 4 (both numerators) = 8]/[3 x 5 (both denominators) = 15] = 8/15

Another way of wording this question is “How much is two-thirds ***of*** four-fifths?” or “How much is two-thirds ***times*** four-fifths?”

Dividing Fractions
This is done with a twist to the multiplication of fractions. You must multiply the reciprocal of the second fraction. The reciprocal is found by turning the second fraction upside down and then multiplying it by the first fraction.

For example: ¾ ÷ 5/8 becomes ¾ x 8/5.
This is solved as [3 x 8 (both numerators) = 24]/[4 x 5 (both denominators) = 20) = 24/20 which can be reduced to 6/5 when both the 24 (the numerator) and the 20 (the denominator) are divided by 4.

You must be careful to only use the reciprocal of the ***second fraction.***

Any number divided by itself is 1. For example: 2/3 ÷ 2/3 = 1 or (2 x 3 = 6)/(3 x 2 = 6) = 6/6 = 1

Converting a Mixed Number to a Fraction
5 7/8 is a mixed number. To convert it to a fraction, you must multiply the whole number (5) by the denominator (8) and add it to the numerator (7) and your answer goes over the same denominator. Thus you get 5 x 8 = 40 + 7 = 47/8.

Adding Mixed Numbers
You must add the two whole numbers and add the two fractions.

For example:
4 ¾ + 2 3/8 = (4 + 2 = 6) + (3/4 + 3/8 = 6/8 + 3/8 = 9/8 = 1 1/8) so now you get 6 + 1 1/8 = 7 1/8.

Subtracting Mixed Numbers
What is 5 7/9 – 3 2/3? Subtract the whole numbers (5 – 3 = 2) and subtract the fractions (7/9 – 2/3 = 7/9 – 6/9 = 1/9) so now you have 2 1/9.

But what if you had 5 5/9 – 3 2/3? When you try to subtract the fractions it is 5/9 – 6/9. This will not work because 6 is larger than 5. You must “slice up” the first whole number to become 4 9/9. Thus your have [4 – 3 (both numerators) = 1] and subtract the fractions that now read [9/9 + 5/9 = 14/9 – 6/9 = 8/9). Your final answer is now 1 8/9.

Another way of subtracting mixed numbers is to change them to improper fractions and then subtract them.

For example:
What is 5 7/9 – 3 2/3? The improper fractions are 52/9 – 11/3 = 52/9 – 33/9 = 19/9 = 2 1/9
What is 5 5/9 – 3 2/3? The improper fractions are 50/9 – 11/3 = 50/9 – 33/9 = 17/9 = 1 8/9

Multiplying and Dividing Mixed Numbers
The simplest way is to convert the mixed numbers to fractions and either multiply or divide.

For example:
3 1/3 x 4 ¾ = 10/3 x 19/4 = 190/12 = 15 10/12 or 15 5/6 when the numerator (10) and the denominator (12) are divided by 2.

Practice Questions:

1. 6/7 + 4/7 = ?
2. 3/5 + 3/8 + 5/4 + 3/10 = ?
3. 7/8 – 1/3 = ?
4. ¾ x 4/5 = ?
5. 3/5 ÷ ¾ = ?
6. 2/3 ÷ 2/3 = ?
7. 7 2/3 + 4 ¼ = ?
8. 8 3/8 - 7 5/8 = ?
9. 3 2/3 ÷ 4 ¾ = ?
10. 3 5/8 x 5 4/5 = ?

Chapter 7: Multiplying Different Signs

When multiplying a negative number by a positive number (or a positive number by a negative number) the answer is negative.

For example:

$-3 \times 4 = -12$ or $4 \times -3 = -12$

When multiplying a negative number by a negative number the answer is positive.

For example:

$-3 \times -4 = 12$

Chapter 8: Decimals

Fractions and decimals are similar but are written differently. For example: the fraction 1/10 is written 0.1.

A decimal carries the decimal place-value system, which is based on the number 10, into the domain of fractions that are based on 10, namely 1/10. 1/100, 1/1,000, etc. It is always best to write a decimal with a 0 in front of the decimal. For example: .6 should be written 0.6.

Moving the Decimal Point to the Right

By moving the decimal point one number to the right, you are multiply the number by 10. By moving the decimal point two numbers to the right, you are multiply the number by 100.

For example:

- 263.12 becomes 2,631.2 (263.12 x 10)
- 263.12 becomes 26,312.0 (263.12 x 100)

Moving the Decimal Point to the Left

By moving the decimal point one number to the left, you are multiplying the number by 1/10 or dividing the number by 10. By moving the decimal point two numbers to the left, you are multiply the number by 1/100 or dividing the number by 100.

For example:

- 263.12 becomes 26.312 (263.12 ÷ 10)
- 263.12 becomes 2.6312 (263.12 ÷ 100)

Adding and Subtracting Decimals

You should keep your columns straight by having the same amount of numbers under each other.

For example: Add 2,500 + 0.007 becomes

2,500.000
+ 0.007
2,500.007

Subtract .007 from 2,500 becomes

```
 2,500.000
–     0.007
 2,499.993
```

Multiplying Decimals

For example: 5.75 x 8.7

Multiply as though they were whole numbers and then take care of the decimal place.

First: 575 x 87 = 50,025

Second: 5.75 has two decimal places to the right and 8.7 has one decimal place to the right, so you add 2 + 1 = 3. You then insert the decimal in your answer three places to the left to get 50.025

Here is another example: Multiply .003 x 0.07

First: 3 x 7 =21

Second: There are 5 decimal places so the answer becomes 0.00021.

Dividing Decimals

For example: 5.0 ÷ 0.5

Get rid of the decimal in the divisor (0.5 becomes 5 by moving the decimal one place to the right). Next move the same number of decimals in the numerator to the right. You now have 50/5 = 10.

Here is another example: 9.31 ÷ 0.4 becomes 93.1 ÷ 4 = 23.275

Rounding off numbers following decimals

If you want to "round off" to three decimal places (that is, only have three numbers to the right of the decimal point) the rule is that if the fourth number (the next number to the desired number to the right) is 5 or greater, the third number is increased by 1.

For example: Round 4.67889 to three decimal places. It becomes 4.679 because the number after 8 (the third number) is 8 which is greater than 4 or 5 or greater.

Round 4.67849 to three decimal places becomes 4.678 because the number after 8 is 4. You do not go to the fifth number.

Chapter 9: Percentages

Percentages are the mathematical equivalent of fractions and decimals. Percent means "per hundred". 42% means 42 per hundred.

Decimals are converted to percentages by moving their decimal point two places to the right and percents can be converted to decimals by moving their decimal point two places to the left.

For example: 0.32 = 32% and 45% = 0.45

Change Fractions to Percentages
Change the fraction to a percentage by dividing the numerator by the denominator and then change the decimal to a percentage by moving the decimal point two places to the right.

For example: 3/5 = .6 = 60%

Change Percentages to Fractions
Move the decimal two places to the left. Change the number to the right of the decimal into a fraction of 10 (or 100, 1,000 depending on the number of decimal places).

For example: 235% = 2.35 = 235/100

Finding Percentage Changes
A person earning $250 a week got a $50 raise. What percent was that?
The formula is "the change/ the original number", thus 50/250 = 1/5 = 20/100 = 20%.

Percentage Increases
If you double a number, did it increase 200% or 100%? (Let's say the number was 100 and was doubled to 200). Using the formula, the increase was 100/100 = 1 = 100%.

Percentage Decreases
The same formula is used. If a person used to work 40 hours a week and now only work 36 hours, what was the percentage change? It would be 4(the amount of change)/40 = 10%. A 100% decrease always gives an answer of 0.

Calculations Using Percentages

A person is earning $2,000 a month and must pay 16% of that in taxes. What is the amount paid in taxes?

Change the percent used into a decimal and multiply. Thus you get $2,000 x .16 = $320 or $160 for every $1,000 earned.

Practice Questions:

1. A person weighed 180 pounds and wanted to lose 40 pounds. What percent is that? (Round off to two decimal places)

2. A person earned $400 a week and wanted a 15% raise. How much would the raise be?

Chapter 10: Basic Algebra

Letters, called variables, are often used to represent numbers. For example: $x + 5 = 12$.

This is solved by moving the actual number on the left to the right side of the = sign and changing the sign of the number. Thus: $x + 5 = 12$ becomes $x = 12 – 5 = 7$.

Brackets are often used for multiplication and division. For example: $3 (x) = 30$.

This is solved by moving the actual number on the left to the right side of the = sign and changing the sign of the number. Thus $3 (x) = 30$ becomes $x = 30 \div 3 = 10$.

Here is another example: $4 = 40/ x$

This is solved by moving the actual number on the right to the left side of the = sign and making that number the numerator in a fraction. Thus $4 = 40/x$ becomes $40/4 = x$ or $10 = x$

Practice Questions:

1. $x + 102 = 210$
2. $56 = x – 43$
3. $4 (x + 7) = 64$
4. $5 = 125/x$
5. $x (16) = 192$

ANSWERS for All Chapters

Chapter 1: Addition

1. 153
462
789
1,404

2. 1,004
3,425
9,065
13,494

3. 436
780
111
459
1,786

Chapter 2: Subtraction

1. 200
–98
102

2. 403
– 398
5

3. 683
–342
– 24
317

4. After the first floor there were 15 – 3 = 12 people left. After the second floor, there were 12 – 6 = 6 people left. Another way to calculate this is: 3 got off on the first floor + 6 got off on the second floor (3 + 6 = 9), leaving 15–9 = 6 people left.

Chapter 3: Multiplication

Answers to the multiplication table:

x	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	64	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

1. 322 x 678 = 218,316

```
     322
    x678
    2,576
  2,254
1,932
218,316
```

2. 6,781 x 542 = 3,675,302

```
      6,781
       x542
     13,562
   27,124
 33,905
3,675,302
```

Chapter 4: Dividing

1. 1,002 ÷ 8 = 125 R2 or 125.25 (2 ÷ 8 = .25)

2. 4,004 ÷ 4 = 1,001

Chapter 6: Fractions and Mixed Numbers

1. 6/7 + 4/7 = 10/7 = 1 3/7

2. 3/5 + 3/8 + 5/4 + 3/10 = 24/40 + 15/40 + 50/40 + 12/40 = 101/40 = 2 21/40

3. 7/8 – 1/3 = 21/24 – 8/24 = 13/24

4. ¾ x 4/5 = 12/20 = 3/5

5. 3/5 ÷ ¾ = 3/5 x 4/3 = 12/15 = 4/5

6. 2/3 ÷ 2/3 = 1

7. 7 2/3 + 4 ¼ = (7 + 4 = 11) + (2/3 + ¼ = 8/12 + 3/12 = 11/12) = 11 11/12

8. 8 3/8 - 7 5/8 = (7 – 7 = 0) – (8/8 + 3/8 = 11/8 - 5/8 = 6/8 = ¾)

9. 3 2/3 ÷ 4 ¾ = 11/3 ÷ 19/4 = 11/3 x 4/19 = 44/57

10. 3 5/8 x 5 4/5 = 29/8 x 29/5 = 841/40 = 21 1/40 or 21.025

Chapter 9: Percentages

1. 40/180 = .2222 = 22.22%

2. 400 x .15 = $60

Chapter 10: Basic Algebra

1. x + 102 = 210
   x = 210 – 102 = 108

2. 56 = x – 43
   56 + 43 = x = 99

3. 4 (x + 7) = 64
   4x + 28 = 64
   4x = 64 – 28
   4x = 36
   x = 36/4 = 9

4. 5 = 125/x
   125/5 = x = 25

5. x (16) = 192
   x = 192/16 = 12