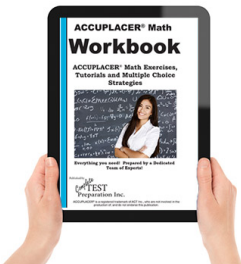


# ACCUPLACER®

## Math

# Workbook

**Math Exercises, Tutorials and  
Multiple Choice Strategies**



ACCUPLACER® Math Workbook

Over 200 ACCUPLACER® Practice Questions, Tutorials, Test Tips, and Multiple Choice Strategies!

Over 200 ACCUPLACER® Math practice questions, plus test tips, how to study math, multiple choice strategies and more!

<https://www.test-preparation.ca/accuplacer/accuplacer-math/>

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# Getting Started

**C**ONGRATULATIONS! By deciding to take the ACCUPLACER® you have taken the first step toward a great future! Of course, there is no point in taking this important examination unless you intend to do your best to earn the highest grade that you possibly can. That means getting yourself organized and discovering the best approaches, methods and strategies to master the material. Yes, that will require real effort and dedication on your part but if you are willing to focus your energy and devote the study time necessary, before you know it you will be passing the ACCUPLACER® with a great score!

We know that taking on a new endeavor can be a little scary, and it is easy to feel unsure of where to begin. That's where we come in. This workbook is designed to help you improve your test-taking skills, show you a few tricks of the trade and increase both your competency and confidence.

## **The ACCUPLACER® Exam Math Content**

### **Numerical Skills**

- Scientific Notation
- Exponents and Radicals
- Square Root
- Fractions, Decimals and Percent
- Means, Median and Modes



## Algebra

Solve real world problems with ratio and proportion  
Solve one and two variable equations  
Identify and solve quadratic equations given values or graphs  
Solve quadratic using different methods  
Translate real world problems into quadratic equations and solve

## Advanced Algebra

Trigonometry  
Logarithms  
Sequences

## Simple Geometry

Slope of a line  
Identify linear equations from a graph  
Calculate perimeter, circumference and volume  
Solve problems using the Pythagorean theorem  
Determine geometric transformations  
Solve real world problems using the properties of geometric shapes

# The ACCUPLACER® Study Plan

Now that you have made the decision to take the ACCUPLACER®, it is time to get started. Before you do another thing, you will need to figure out a plan of attack. The best study tip is to start early! The longer the time period you devote to regular study practice, the more likely you will be to retain the material and be able to access it quickly. If you thought that  $1 \times 20$  is the same as  $2 \times 10$ , guess what? It

really is not, when it comes to study time. Reviewing material for just an hour per day over the course of 20 days is far better than studying for two hours a day for only 10 days. The more often you revisit a particular piece of information, the better you will know it. Not only will your grasp and understanding be better, but your ability to reach into your brain and quickly and efficiently pull out the tidbit you need, will be greatly enhanced as well.

The great Chinese scholar and philosopher Confucius believed that true knowledge could be defined as knowing both what you know and what you do not know. The first step in preparing for the ACCUPLACER® is to assess your strengths and weaknesses. You may already have an idea of what you know and what you do not know, but evaluating yourself for each of the math areas will clarify the details.

## Making a Study Schedule

To make your study time the most productive you will need to develop a study plan. The purpose of the plan is to organize all the bits of pieces of information in such a way that you will not feel overwhelmed. Rome was not built in a day, and learning everything you will need to know to pass the ACCUPLACER® is going to take time, too. Arranging the material you need to learn into manageable chunks is the best way to go. Each study session should make you feel as though you have accomplished your goal, and your goal is simply to learn what you planned to learn during that particular session. Try to organize the content in such a way that each study session builds on previous ones. That way, you will retain the information, be better able to access it, and review the previous bits and pieces at the same time.

# Basic Math

**T**HE BASIC MATH SECTION COVERS:

- Fractions, Decimals and Percent
- Scientific Notation
- Exponents and Radicals

## Fraction Tips, Tricks and Shortcuts

When you are writing an exam, time is precious, and anything you can do to answer faster is a real advantage. Here are some ideas, shortcuts, tips and tricks that can speed up answering fractions problems.

Remember that a fraction is just a number which names a portion of something. For instance, instead of having a whole pie, a fraction says you have a part of a pie--such as a half of one or a fourth of one.

Two digits make up a fraction. The digit on top is known as the numerator. The digit on the bottom is known as the denominator. To remember which is which, just remember that “denominator” and “down” both start with a “d.” And the “downstairs” number is the denominator. So for instance, in  $\frac{1}{2}$ , the numerator is the 1 and the denominator (or “downstairs”) number is the 2.

- It’s easy to add two fractions if they

have the same denominator. Just add the digits on top, and leave the bottom one the same:  $1/10 + 6/10 = 7/10$ .

- It's the same with subtracting fractions with the same denominator:  $7/10 - 6/10 = 1/10$ .
- Adding and subtracting fractions with different denominators is a little more complicated. First, you have to get the problem so that they do have the same denominators. The easiest way to do this is to multiply the denominators: For  $2/5 + 1/2$  multiply 5 by 2. Now you have a denominator of 10. But now you have to change the top numbers too. Since you multiplied the 5 in  $2/5$  by 2, you also multiply the 2 by 2, to get 4. So the first number is now  $4/10$ . Since you multiplied the second number times 5, you also multiply its top number by 5, to get a final fraction of  $5/10$ . Now you can add 4 and 5 together to get a final sum of  $9/10$ .
- Sometimes you'll be asked to reduce a fraction to its simplest form. This means getting it to where the only common factor of the numerator and denominator is 1. Think of it this way: Numerators and denominators are brothers that must be treated the same. If you do something to one, you must do it to the other, or it's just not fair. For instance, if you divide your numerator by 2, then you should also divide the denominator by the same. Let's take an example: The fraction  $2/10$ . This is not reduced to its simplest terms because there is a number that will divide evenly into both: the number 2. We want to make it so that the only number that will divide evenly into both is 1. What can we divide into 2 to get 1? The number 2, of course! Now to be "fair," we have to do the same thing to the denominator: Divide 2 into 10 and you get 5. So our new, re-

duced fraction is  $1/5$ .

- In some ways, multiplying fractions is the easiest of all: Just multiply the two top numbers and then multiply the two bottom numbers. For instance, with this problem:  
 $2/5 \times 2/3$  you multiply 2 by 2 and get a top number of 4; then multiply 5 by 3 and get a bottom number of 15. Your answer is  $4/15$ .
- Dividing fractions is more involved, but still not too hard. You once again multiply, but only AFTER you have turned the second fraction upside-down. To divide  $7/8$  by  $1/2$ , turn the  $1/2$  into  $2/1$ , then multiply the top numbers and multiply the bottom numbers:  $7/8 \times 2/1$  gives us 14 on top and 8 on the bottom.

## Converting Fractions to Decimals

There are a couple of ways to become good at converting fractions to decimals. The fastest way is to memorize some basic fraction facts. Here are fractions that you should know:

$1/100$  is “one hundredth,” expressed as a decimal, it’s .01.

$1/50$  is “two hundredths,” expressed as a decimal, it’s .02.

$1/25$  is “one twenty-fifths” or “four hundredths,” expressed as a decimal, it’s .04.

$1/20$  is “one twentieth” or “five hundredths,” expressed as a decimal, it’s .05.

$1/10$  is “one tenth,” expressed as a decimal, it’s .1.

# Answer Sheet

1. (A) (B) (C) (D)
2. (A) (B) (C) (D)
3. (A) (B) (C) (D)
4. (A) (B) (C) (D)
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46. (A) (B) (C) (D)
47. (A) (B) (C) (D)
48. (A) (B) (C) (D)
49. (A) (B) (C) (D)
50. (A) (B) (C) (D)

## Basic Math Practice

1.  $2/3 + 5/12 =$

- a.  $9/17$
- b.  $3/11$
- c.  $7/12$
- d.  $1 \frac{1}{12}$

2.  $3/5 + 7/10 =$

- a.  $1 \frac{1}{10}$
- b.  $7/10$
- c.  $1 \frac{3}{10}$
- d.  $1 \frac{1}{12}$

3.  $4/5 - 2/3 =$

- a.  $2/2$
- b.  $2/13$
- c.  $1$
- d.  $2/15$

4.  $13/16 - 1/4 =$

- a.  $1$
- b.  $12/12$
- c.  $9/16$
- d.  $7/16$

**5.  $15/16 \times 8/9 =$**

- a.  $5/6$
- b.  $16/37$
- c.  $2/11$
- d.  $5/7$

**6.  $3/4 \times 5/11 =$**

- a.  $2/15$
- b.  $15/44$
- c.  $3/19$
- d.  $15/44$



## Answer Key

**1. D**

A common denominator is needed, which both 3 and 12 will divide into. So,  $8 + 5/12 = 13/12 = 1 \frac{1}{12}$

**2. C**

A common denominator is needed for 5 and 10.  
 $6 + 7/10 = 13/10 = 1 \frac{3}{10}$

**3. D**

A common denominator is needed for 5 and 3.  
 $12 - 10/15 = 2/15$

**4. C**

A common denominator is needed for 16 and 4.  
 $13 - 4/16 = 9/16$

**5. A**

Since there are common numerators and denominators to cancel out, we cancel out  $15/16 \times 8/9$  to get  $5/2 \times 1/3$ , and then multiply numerators and denominators to get  $5/6$

**6. D**

Since there are no common numerators and denominators to cancel out, we simply multiply the numerators and then the denominators. So  $3 \times 5/4 \times 11 = 15/4$

# Word Problems

**W**ORD PROBLEMS ARE INCLUDED IN THE NUMERICAL SKILLS SECTION OF THE MATHEMATICS TEST.

## How to Solve Word Problems

Most students find math word problems difficult. Tackling word problems is much easier if you have a systematic approach which we outline below.

Here is the biggest tip for studying word problems.

**Practice regularly and systematically.** Sounds simple and easy right? Yes it is, and yes it really does work.

Word problems are a way of thinking and require you to translate a real world problem into mathematical terms.

Some math instructors go so far as to say that learning how to think mathematically is the main reason for teaching word problems.

So what do we mean by Practice regularly and systematically? Studying word problems and math in general requires a logical and mathematical frame of mind. The only way that you can get this is by practicing regularly, which means everyday.

It is critical that you practice word problems

everyday for the 5 days before the exam as a bare minimum.

If you practice and miss a day, you have lost the mathematical frame of mind and the benefit of your previous practice is pretty much gone. Anyone who has done any number of math tests will agree – you have to practice everyday.

**Everything is important.** The other critical point about word problems is that all the information given in the problem has some purpose. There is no unnecessary information! Word problems are typically around 50 words in 1 to 3 sentences. If the sometimes complicated relationships are to be explained in that short an explanation, every word has to count. Make sure that you use every piece of information.

**Here are 9 simple steps to solve word problems.**

**Step 1** – Read through the problem at least three times. The first reading should be a quick scan, and the next two readings should be done slowly to answer these important questions:

What does the problem ask? (Usually located towards the end of the problem)

What does the problem imply? (This is usually a point you were asked to remember).

Mark all information, and underline all important words or phrases.

**Step 2** – Try to make a pictorial representation of the problem such as a circle and an arrow to show travel.

This makes the problem a bit more real and sensible to you.

## 2. Distance or Speed

Two boats travel down a river towards the same destination, starting at the same time. One boat is traveling at 52 km/hr, and the other boat at 43 km/hr. How far apart will they be after 40 minutes?

- a. 46.67 km
- b. 19.23 km
- c. 6.4 km
- d. 14.39 km

### Solution: C

After 40 minutes, the first boat will have traveled =  $52 \text{ km/hr} \times 40 \text{ minutes}/60 \text{ minutes} = 34.7 \text{ km}$

After 40 minutes, the second boat will have traveled =  $43 \text{ km/hr} \times 40/60 \text{ minutes} = 28.66 \text{ km}$

Difference between the two boats will be  $34.7 \text{ km} - 28.66 \text{ km} = 6.04 \text{ km}$ .

### Multiple Choice Strategy

First estimate the answer. The first boat is traveling 9 km. faster than the second, for 40 minutes, which is  $\frac{2}{3}$  of an hour.  $\frac{2}{3}$  of 9 = 6, as a rough guess of the distance apart.

Choices A, B and D can be eliminated right away.

# Answer Sheet

1. (A) (B) (C) (D)    11. (A) (B) (C) (D)    21. (A) (B) (C) (D)
2. (A) (B) (C) (D)    12. (A) (B) (C) (D)    22. (A) (B) (C) (D)
3. (A) (B) (C) (D)    13. (A) (B) (C) (D)    23. (A) (B) (C) (D)
4. (A) (B) (C) (D)    14. (A) (B) (C) (D)    24. (A) (B) (C) (D)
5. (A) (B) (C) (D)    15. (A) (B) (C) (D)    25. (A) (B) (C) (D)
6. (A) (B) (C) (D)    16. (A) (B) (C) (D)
7. (A) (B) (C) (D)    17. (A) (B) (C) (D)
8. (A) (B) (C) (D)    18. (A) (B) (C) (D)
9. (A) (B) (C) (D)    19. (A) (B) (C) (D)
10. (A) (B) (C) (D)    20. (A) (B) (C) (D)

## Word Problem Practice

**1. Translate the following into an equation: Five greater than 3 times a number.**

- a.  $3X + 5$
- b.  $5X + 3$
- c.  $(5 + 3)X$
- d.  $5(3 + X)$

**2. Translate the following into an equation: three plus a number times 7 equals 42.**

- a.  $7(3 + X) = 42$
- b.  $3(X + 7) = 42$
- c.  $3X + 7 = 42$
- d.  $(3 + 7)X = 42$

**3. Translate the following into an equation: 2 + a number divided by 7.**

- a.  $(2 + X)/7$
- b.  $(7 + X)/2$
- c.  $(2 + 7)/X$
- d.  $2/(7 + X)$

**4. Translate the following into an equation: six times a number plus five.**

- a.  $6X + 5$
- b.  $6(X+5)$
- c.  $5X + 6$
- d.  $(6 * 5) + 5$

**5. A box contains 7 black pencils and 28 blue ones. What is the ratio between the black and blue pens?**

- a. 1:4
- b. 2:7
- c. 1:8
- d. 1:9

**6. The manager of a weaving factory estimates that if 10 machines run at 100% efficiency for 8 hours, they will produce 1450 meters of cloth. Due to some technical problems, 4 machines run of 95% efficiency and the remaining 6 at 90% efficiency. How many meters of cloth can these machines will produce in 8 hours?**

- a. 1334 meters
- b. 1310 meters
- c. 1300 meters
- d. 1285 meters

**7. In a local election at polling station A, 945 voters cast their vote out of 1270 registered voters. At polling station B, 860 cast their vote out of 1050 registered voters and at station C, 1210 cast their vote out of 1440 registered voters. What is the total turnout from all three polling stations?**

- a. 70%
- b. 74%
- c. 76%
- d. 80%

# Answer Key

## Part 1 - Equation Translation

### 1. A

Five greater than 3 times a number.

$5 + 3$  times a number.

$$3X + 5$$

### 2. A

Three plus a number times 7 equals 42.

Let  $X$  be the number.

$$(3 + X) \text{ times } 7 = 42$$

$$7(3 + X) = 42$$

### 3. A

2 + a number divided by 7.

$(2 + X)$  divided by 7.

$$(2 + X)/7$$

### 4. B

Six times a number plus five is the same as saying six times (a number plus five). Or,

$6 * (\text{a number plus five})$ . Let  $X$  be the number so,

$$6(X + 5).$$

### 5. A

The ratio between black and blue pens is 7 to 28 or 7:28.

Bring to the lowest terms by dividing both sides by 7 gives 1:4.

### 6. A

At 100% efficiency 1 machine produces  $1450/10 = 145$  m of cloth.

At 95% efficiency, 4 machines produce  $4 * 145 * 95/100 =$



551 m of cloth.

At 90% efficiency, 6 machines produce  $6 * 145 * 90/100 = 783$  m of cloth.

Total cloth produced by all 10 machines =  $551 + 783 = 1334$  m

Since the information provided and the question are based on 8 hours, we did not need to use time to reach the answer.

### 7. D

To find the total turnout in all three polling stations, we need to proportion the number of voters to the number of all registered voters.

Number of total voters =  $945 + 860 + 1210 = 3015$

Number of total registered voters =  $1270 + 1050 + 1440 = 3760$

Percentage turnout over all three polling stations =  $3015 * 100/3760 = 80.19\%$

Checking the answers, we round 80.19 to the nearest whole number: 80%

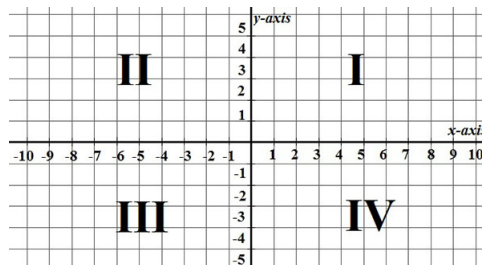
# Basic Geometry

**T**HE BASIC GEOMETRY SECTION INCLUDES:

- slope of a line
- Identify linear equations from a graph
- Calculate perimeter, circumference and volume
- Solve problems using the Pythagorean theorem
- Determine geometric transformations
- Solve real world problems using the properties of geometric shapes

## Cartesian Plane, Coordinate Grid and Plane

To locate points and draw lines and curves, we use the coordinate plane. It is also called Cartesian coordinate plane. It is a two-dimensional surface with a coordinate grid in it, which helps us to count the units. For the counting of those units, we use x-axis (horizontal scale) and y-axis (vertical scale).



The whole system is called a coordinate system which is divided into 4 parts, called quadrants. The quadrant where all numbers are positive is the 1st quadrant (I), and if we go counterclockwise, we mark all 4 quadrants.

The location of a dot in the coordinate system is represented by coordinates. Coordinates are represented as a pair of numbers, where the 1st number is located on the x-axis and the 2nd number is located on the y-axis. So, if a dot A has coordinates a and b, then we write:

$$A=(a,b) \text{ or } A(a,b)$$

The point where x-axis and y-axis intersect is called an origin. The origin is the point from which we measure the distance along the x and y axes.

In the Cartesian coordinate system we can calculate the distance between 2 given points. If we have dots with coordinates:

$$A=(a,b)$$

$$B=(c,d)$$

Then the distance d between A and B can be calculated by the following formula:

$$d = \sqrt{(c - a)^2 + (d - b)^2}$$

Cartesian coordinate system is used for the drawing of 2-dimensional shapes, and is also commonly used for functions.

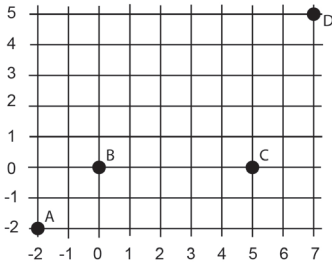
**Example:**

Draw the function  $y = (1 - x)/2$

# Answer Sheet

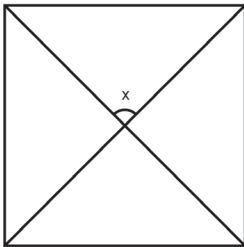
1. (A) (B) (C) (D)    21. (A) (B) (C) (D)
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6. (A) (B) (C) (D)    26. (A) (B) (C) (D)
7. (A) (B) (C) (D)    27. (A) (B) (C) (D)
8. (A) (B) (C) (D)    28. (A) (B) (C) (D)
9. (A) (B) (C) (D)    29. (A) (B) (C) (D)
10. (A) (B) (C) (D)    30. (A) (B) (C) (D)
11. (A) (B) (C) (D)    31. (A) (B) (C) (D)
12. (A) (B) (C) (D)    32. (A) (B) (C) (D)
13. (A) (B) (C) (D)    33. (A) (B) (C) (D)
14. (A) (B) (C) (D)    34. (A) (B) (C) (D)
15. (A) (B) (C) (D)    35. (A) (B) (C) (D)
16. (A) (B) (C) (D)    36. (A) (B) (C) (D)
17. (A) (B) (C) (D)    37. (A) (B) (C) (D)
18. (A) (B) (C) (D)    38. (A) (B) (C) (D)
19. (A) (B) (C) (D)    39. (A) (B) (C) (D)
20. (A) (B) (C) (D)    40. (A) (B) (C) (D)

# Geometry Practice Questions



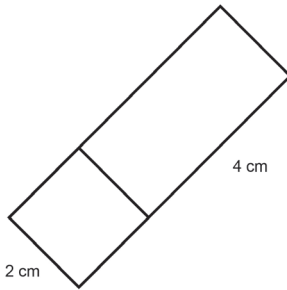
1. Which of the above points represents the origin?

- a. A
- b. B
- c. C
- d. D



2. What is measurement of the indicated angle?

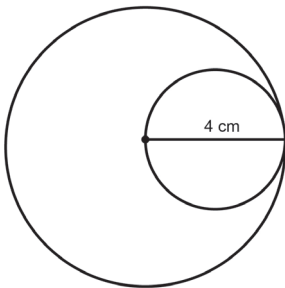
- a.  $45^\circ$
- b.  $90^\circ$
- c.  $60^\circ$
- d.  $30^\circ$



**Note:** figure not drawn to scale.

**3. Assuming the figure with side 2 cm. is square, what is the perimeter of the above shape?**

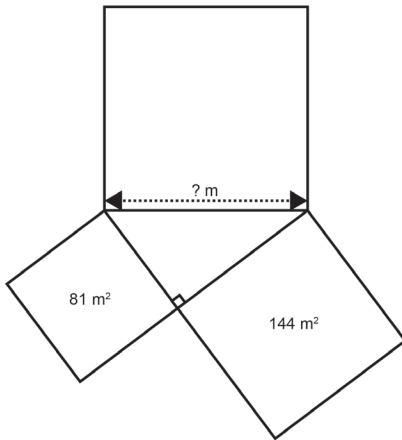
- a. 12 cm
- b. 16 cm
- c. 6 cm
- d. 20 cm



**Note:** Figure not drawn to scale

4. Assuming the diameter of the small circle is the radius of the larger circle, what is (area of large circle) - (area of small circle) in the figure above?

- a.  $8 \pi \text{ cm}^2$
- b.  $10 \pi \text{ cm}^2$
- c.  $12 \pi \text{ cm}^2$
- d.  $16 \pi \text{ cm}^2$



Note: Figure not drawn to scale

5. Assuming the shapes around the center right triangle are square, what is the length of each side of the indicated square above?

- a. 10
- b. 15
- c. 20
- d. 5

## Answer Key

### 1. A

Point A represents the origin.

### 2. A

The diagonals of a square intersect at right angles, so each angle measures  $90^\circ$ . Half of that angle will be  $45^\circ$ .

### 3. B

We see that there is a square with side 2 cm and a rectangle adjacent to it, with one side 2 cm (common side with the square) and the other side 4 cm. The perimeter of a shape is found by summing up all sides surrounding the shape, not adding the ones inside the shape. Three 2 cm sides from the square, and two 4 cm sides and one 2 cm side from the rectangle contribute the perimeter.

So, the perimeter of the shape is:  $2 + 2 + 2 + 4 + 2 + 4 = 16$  cm.

### 4. C

In the figure, we are given a large circle and a small circle inside it; with the diameter equal to the radius of the large one. The diameter of the small circle is 4 cm. This means that its radius is 2 cm. Since the diameter of the small circle is the radius of the large circle, the radius of the large circle is 4 cm. The area of a circle is calculated by:  $\pi r^2$  where  $r$  is the radius.

Area of the small circle:  $\pi(2)^2 = 4\pi$

Area of the large circle:  $\pi(4)^2 = 16\pi$

The difference area is found by:

Area of the large circle - Area of the small circle =  $16\pi - 4\pi = 12\pi$

### 5. B

We see that there are three squares forming a right triangle in the middle. Two of the squares have the



areas  $81 \text{ m}^2$  and  $144 \text{ m}^2$ . If we denote their sides  $a$  and  $b$  respectively:

$a^2 = 81$  and  $b^2 = 144$ . The length which is asked is the hypotenuse;  $a$  and  $b$  are the opposite and adjacent sides of the right angle. By using the Pythagorean Theorem, we can find the value of the asked side:

**Pythagorean Theorem:**

$$(\text{Hypotenuse})^2 = (\text{Opposite Side})^2 + (\text{Adjacent Side})^2$$

$$h^2 = a^2 + b^2$$

$a^2 = 81$  and  $b^2 = 144$  are given. So;

$$h^2 = 81 + 144$$

$$h^2 = 225$$

$$h = 15 \text{ m}$$

# Basic Algebra

**T**HE BASIC ALGEBRA SECTION COVERS THE FOLLOWING:

- Ratio and proportion
- Linear equations with 1 and 2 variables
- Quadratics
- Real-world quadratic questions
- Identify quadratic equations from graphs
- Identify linear equations from graphs
- Polynomials
- Solve Geometric problems with Algebra

## Solving One-Variable Linear Equations

Linear equations with variable  $x$  is an equation with the following form:

$$ax = b$$

where  $a$  and  $b$  are real numbers. If  $a=0$  and  $b$  is different from 0, then the equation has no solution.

Let's solve one simple example of a linear equation with one variable:

$$4x - 2 = 2x + 6$$

When we are given this type of equation, we are always moving variables to the one side, and real numbers to the other side of the equals sign. Always remember: if you are changing sides, you are changing signs. Let's move all variables to the left, and real

number to the right side:

$$4x - 2 = 2x + 6$$

$$4x - 2x = 6 + 2$$

$$2x = 8$$

$$x = 8/2$$

$$x = 4$$

When  $2x$  goes to the left it becomes  $-2x$ , and  $-2$  goes to the right and becomes  $+2$ . After calculations, we find that  $x$  is  $4$ , which is a solution of our linear equation.

Let's solve a little more complex linear equation:

$$2x - 6/4 + 4 = x$$

$$2x - 6 + 16 = 4x$$

$$2x - 4x = -16 + 6$$

$$-2x = -10$$

$$x = -10/-2$$

$$x = 5$$

We multiply whole equation by  $4$ , to lose the fractional line. Now we have a simple linear equation. If we change sides, we change the signs.

## Solving Two-Variable Linear Equations

If we have 2 or more linear equations with 2 or more variables, then we have a system of linear equations. The idea here is to express one variable using the other in one equation, and then use it in the second equation, so we get a linear equation with one variable. Here is an example:

$$x - y = 3$$

$$2x + y = 9$$

# Answer Sheet

- |                     |                     |                     |
|---------------------|---------------------|---------------------|
| 1. (A) (B) (C) (D)  | 18. (A) (B) (C) (D) | 35. (A) (B) (C) (D) |
| 2. (A) (B) (C) (D)  | 19. (A) (B) (C) (D) | 36. (A) (B) (C) (D) |
| 3. (A) (B) (C) (D)  | 20. (A) (B) (C) (D) | 37. (A) (B) (C) (D) |
| 4. (A) (B) (C) (D)  | 21. (A) (B) (C) (D) | 38. (A) (B) (C) (D) |
| 5. (A) (B) (C) (D)  | 22. (A) (B) (C) (D) | 39. (A) (B) (C) (D) |
| 6. (A) (B) (C) (D)  | 23. (A) (B) (C) (D) | 40. (A) (B) (C) (D) |
| 7. (A) (B) (C) (D)  | 24. (A) (B) (C) (D) | 41. (A) (B) (C) (D) |
| 8. (A) (B) (C) (D)  | 25. (A) (B) (C) (D) | 42. (A) (B) (C) (D) |
| 9. (A) (B) (C) (D)  | 26. (A) (B) (C) (D) | 43. (A) (B) (C) (D) |
| 10. (A) (B) (C) (D) | 27. (A) (B) (C) (D) | 44. (A) (B) (C) (D) |
| 11. (A) (B) (C) (D) | 28. (A) (B) (C) (D) | 45. (A) (B) (C) (D) |
| 12. (A) (B) (C) (D) | 29. (A) (B) (C) (D) |                     |
| 13. (A) (B) (C) (D) | 30. (A) (B) (C) (D) |                     |
| 14. (A) (B) (C) (D) | 31. (A) (B) (C) (D) |                     |
| 15. (A) (B) (C) (D) | 32. (A) (B) (C) (D) |                     |
| 16. (A) (B) (C) (D) | 33. (A) (B) (C) (D) |                     |
| 17. (A) (B) (C) (D) | 34. (A) (B) (C) (D) |                     |

# Basic Algebra Practice

1. Solve the linear equation:  $-x - 7 = -3x - 9$

- a. -1
- b. 0
- c. 1
- d. 2

2. Solve the system:  $4x - y = 5$     $x + 2y = 8$

- a. (3,2)
- b. (3,3)
- c. (2,3)
- d. (2,2)

3. Simplify the following expression:

$$3x^3 + 2x^2 + 5x - 7 + 4x^2 - 5x + 2 - 3x^3$$

- a.  $6x^2 - 9$
- b.  $6x^2 - 5$
- c.  $6x^2 - 10x - 5$
- d.  $6x^2 + 10x - 9$

4. Find 2 numbers that sum to 21 and the sum of the squares is 261.

- a. 14 and 7
- b. 15 and 6
- c. 16 and 5
- d. 17 and 4

## Answer Key

### 1. A

We should collect similar terms on the same side. Here, we can collect  $x$  terms on left side, and the constants on the right side:

$-x - 7 = -3x - 9$  .... Let us add  $3x$  to both sides:

$$-x - 7 + 3x = -3x - 9 + 3x$$

$2x - 7 = -9$  ... Now, we can add  $+7$  to both sides:

$$2x - 7 + 7 = -9 + 7$$

$2x = -2$  ... Dividing both sides by 2 gives us the value of  $x$ :

$$x = -2/2$$

$$x = -1$$

### 2. C

First, we need to write two equations separately:

$$4x - y = 5 \text{ (I)}$$

$x + 2y = 8$  (II) ... Here, we can use two ways to solve the system. One is substitution method, the other one is linear elimination method:

#### 1. Substitution Method

Equation (I) gives us that  $y = 4x - 5$ . We insert this value of  $y$  into equation (II):

$$x + 2(4x - 5) = 8$$

$$x + 8x - 10 = 8$$

$$9x - 10 = 8$$

$$9x = 18$$

$$x = 2$$

Bu knowing  $x = 2$ , we can find the value of  $y$  by inserting  $x = 2$  into either of the equations. Let us choose equation (I):

$$4(2) - y = 5$$

$$8 - y = 5$$

$$8 - 5 = y$$

$$y = 3 \rightarrow \text{solution is } (2, 3)$$

## 2. Linear Elimination Method:

2•/  $4x - y = 5$  ... by multiplying equation (I) by 2, we see that  $-2y$  will form; and  $y$  terms

$x + 2y = 8$  ... will be eliminated when summed with  $+2y$  in equation (II):

$$2\cdot/ 4x - y = 5$$

$$+ \quad \underline{x + 2y = 8}$$

$$8x - 2y = 10$$

$$+ \quad \underline{x + 2y = 8} \dots \text{Summing side by side:}$$

$8x + x - 2y + 2y = 10 + 8$  ...  $-2y$  and  $+2y$  eliminate each other:

$$9x = 18$$

$$x = 2$$

By knowing  $x = 2$ , we can find the value of  $y$  by inserting  $x = 2$  into either of the equations. Let us choose equation (I):

$$4(2) - y = 5$$

$$8 - y = 5$$

$$8 - 5 = y$$

$$y = 3 \rightarrow \text{solution is } (2, 3)$$

**3. B**

$3x^3 + 2x^2 + 5x - 7 + 4x^2 - 5x + 2 - 3x^3$  ... write similar terms together:

$= 3x^3 - 3x^3 + 2x^2 + 4x^2 + 5x - 5x - 7 + 2$  ... operate within the same terms.  $3x^3$  and  $-3x^3$ ,  $5x$  and  $-5x$  cancel:

$$= 6x^2 - 5$$

**4. B**

There are two statements made. This means that we can write two equations according to these statements:

The sum of two numbers are 21:  $x + y = 21$

The sum of the squares is 261:  $x^2 + y^2 = 261$

We are asked to find  $x$  and  $y$ .

Since we have the sums of the numbers and the sums of their squares; we can use the square formula of  $x + y$ , that is:

$(x + y)^2 = x^2 + 2xy + y^2$  ... Here, we can insert the known values  $x + y$  and  $x^2 + y^2$ :

$(21)^2 = 261 + 2xy$  ... Arranging to find  $xy$ :

$$441 = 261 + 2xy$$

$$441 - 261 = 2xy$$

$$180 = 2xy$$



$$xy = 180/2$$

$$xy = 90$$

We need to find two numbers which multiply to 90. Checking the answer choices, we see that in (b), 15 and 6 are given.  $15 \cdot 6 = 90$ . Also their squares sum up to 261 ( $15^2 + 6^2 = 225 + 36 = 261$ ). So these two numbers satisfy the equation.

# Advanced Algebra

THE ADVANCED ALGEBRA SECTION COVERS THE FOLLOWING:

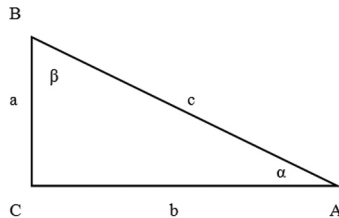
Trigonometry

Sequences

Logarithms

## Trigonometry - A Quick Tutorial

If we are observing a right triangle, where  $a$  and  $b$  are its legs and  $c$  is its hypotenuse, we can use trigonometric functions to make a relationship between angles and sides of the right triangle.



If the right angle of the right triangle ABC is at the point C, then the sine (sin) and the cosine (cos) of the angles  $\alpha$  (at the point A) and  $\beta$  (at the point B) can be found like this:

$$\begin{aligned}\sin\alpha &= a/c & \sin\beta &= b/c \\ \cos\alpha &= b/c & \cos\beta &= a/c\end{aligned}$$

Notice that  $\sin\alpha$  and  $\cos\beta$  are the equal, and same goes for  $\sin\beta$  and  $\cos\alpha$ . So, to find sine of the angle, we divide the side that is

opposite of that angle and the hypotenuse. To find cosine of the angle, we divide the side that makes that angle (adjacent side) by the hypotenuse.

There are 2 more important trigonometric functions, tangent and cotangent:

$$\operatorname{tg}\alpha = \sin\alpha/\cos\alpha = a/b$$

$$\operatorname{ctg}\alpha = \cos\alpha/\sin\alpha = b/a$$

For the functions sine and cosine, there is a table with values for some of the angles, which is to be memorized as it is very useful for solving various trigonometric problems.

	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$
$\sin\alpha$	0	$1/2$	$\sqrt{2}/2$	$\sqrt{3}/2$	1
$\cos\alpha$	1	$\sqrt{3}/2$	$\sqrt{2}/2$	$1/2$	0

Let's see an example:

If  $a$  is 9 cm and  $c$  is 18 cm, find  $\alpha$ .

We can use the sine for this problem:

$$\sin\alpha = a/c = 9/18 = 1/2$$

We can see from the table that if  $\sin\alpha$  is  $1/2$ , then angle  $\alpha$  is  $30^\circ$ .

Besides degrees we can write angles using  $\pi$ , where  $\pi$  represents  $180^\circ$ . For example, angle  $\pi/2$  means a right angle of  $90^\circ$ .

# Answer Sheet

1. (A) (B) (C) (D)    21. (A) (B) (C) (D)
2. (A) (B) (C) (D)    22. (A) (B) (C) (D)
3. (A) (B) (C) (D)    23. (A) (B) (C) (D)
4. (A) (B) (C) (D)    24. (A) (B) (C) (D)
5. (A) (B) (C) (D)    25. (A) (B) (C) (D)
6. (A) (B) (C) (D)    26. (A) (B) (C) (D)
7. (A) (B) (C) (D)    27. (A) (B) (C) (D)
8. (A) (B) (C) (D)    28. (A) (B) (C) (D)
9. (A) (B) (C) (D)    29. (A) (B) (C) (D)
10. (A) (B) (C) (D)    30. (A) (B) (C) (D)
11. (A) (B) (C) (D)    31. (A) (B) (C) (D)
12. (A) (B) (C) (D)    32. (A) (B) (C) (D)
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18. (A) (B) (C) (D)    38. (A) (B) (C) (D)
19. (A) (B) (C) (D)    39. (A) (B) (C) (D)
20. (A) (B) (C) (D)    40. (A) (B) (C) (D)

## Advanced Algebra Practice

1. If sides  $a$  and  $b$  of a right triangle are 8 and 6, respectively, find cosine of  $\alpha$ .

- a.  $1/5$
- b.  $5/3$
- c.  $3/5$
- d.  $2/5$

2. Find tangent of  $\alpha$  of a right triangle, if  $a$  is 3 and  $b$  is 5.

- a.  $1/4$
- b.  $5/3$
- c.  $4/3$
- d.  $3/4$

3. If  $\alpha = 30^\circ$ , find  $\sin 30^\circ + \cos 60^\circ$ .

- a.  $1/2$
- b.  $2/3$
- c. 1
- d.  $3/2$

4. Calculate  $(\sin 230^\circ - \sin 0^\circ) / (\cos 90^\circ - \cos 60^\circ)$ .

- a.  $-1/2$
- b.  $2/3$
- c. 0
- d.  $1/2$

# Answer Key

## Trigonometry

### 1. C

$$a = 8$$

$$b = 6$$

$$a^2 + b^2 = c^2$$

$$8^2 + 6^2 = c^2$$

$$64 + 36 = c^2$$

$$c^2 = 100$$

$$c = 10$$

$$\cos\alpha = b/c = 6/10 = 3/5$$

### 2. D

$$a = 3$$

$$c = 5$$

$$a^2 + b^2 = c^2$$

$$3^2 + b^2 = 5^2$$

$$b^2 = 25 - 9$$

$$b^2 = 16$$

$$b = 4$$

$$\operatorname{tg}\alpha = a/b = 3/4$$

### 3. C

$$\alpha = 30^\circ$$

$$\sin 30^\circ + \cos 60^\circ = 1/2 + 1/2 = 1$$

### 4. A

$$(\sin 230^\circ - \sin 0^\circ) / (\cos 90^\circ - \cos 60^\circ)$$

$$= ((1/2)2 - 0) / (0 - 1/2)$$

$$= (1/4) / (-1/2) = -1/2$$

# Basic Math Multiple Choice

**M**ath is the one subject where you need to make sure that you understand the processes before you ever tackle it. Generally, the time allowed for the math portion is so short there's not much room for error. You have to be fast and accurate. It's imperative that before the test day arrives, you've learned all the main formulas that will be used, and then to create your own problems (and solve them).

On the actual test day, use the "Plug-Check-Check" strategy. Here's how it goes.

Read the problem, but not the answers. You'll want to work the problem first and come up with your own answers. If you do the work right, you will find your answer among the options given.

If you need help with the problem, plug actual numbers into the variables given. You'll find it easier to work with numbers than it is to work with letters. For instance, if the question asks, "If  $Y - 4$  is 2 more than  $Z$ , then  $Y + 5$  is how much more than  $Z$ ?" Try selecting a value for  $Y$ . Let's take 6. Your question now becomes, "If  $6 - 4$  is 2 more than  $Z$ , then 6 plus 5 is how much more than  $Z$ ?" Now your answer is easier to work with.

Check the answer choices to see if your answer matches one of those.

If no answer matches your answer, re-check your math, but this time, use a different method. In math, it's common for there to be more

than one way to solve a problem.

### **Math Multiple Choice Strategy**

The two strategies for working with basic math multiple choice are Estimation and Elimination.

#### **Math Strategy 1 - Estimation.**

Just like it sounds, try to estimate an approximate answer first. Then look at the choices.

#### **Math Strategy 2 - Elimination.**

For every question, no matter what type, eliminating obviously incorrect answers narrows the possible choices. Elimination is probably the most powerful strategy for answering multiple choice.

Here are a few basic math examples.

#### **Solve $2/3 + 5/12$**

- a.  $9/17$
- b.  $3/11$
- c.  $7/12$
- d.  $1 \frac{1}{12}$

First estimate the answer.  $2/3$  is more than half and  $5/12$  is about half, so the answer is going to be very close to 1.

Next, Eliminate. Choice A is about  $1/2$  and can be eliminated, choice B is very small, less than  $1/2$  and can be eliminated. Choice C is close to  $1/2$  and can be eliminated. Leaving only choice D, which is just over 1.



## Fractions Shortcut - Canceling Out

In any operation with fractions, if the numerator of one fraction has a common multiple with the denominator of the other, you can cancel out. This saves time and simplifies the problem quickly, making it easier to manage.

**Solve  $2/15 \div 4/5$**

a.  $6/65$

b.  $6/75$

c.  $5/12$

d.  $1/6$

To divide fractions, we multiply the first fraction with the inverse of the second. Therefore, we have  $2/15 \times 5/4$ . The numerator of the first fraction, 2, shares a multiple with the denominator of the second fraction, 4, which is 2. These cancel out, which gives,  $1/3 \times 1/2 = 1/6$

Canceling out solved the questions very quickly, but we can still use multiple choice strategies to answer.

Choice B can be eliminated because 75 is too large a denominator. Choice C can be eliminated because 5 and 15 don't go into 12.

Choice D is correct.

## Basic Math Multiple Choice Strategy and Shortcuts

Multiplying decimals gives a very quick way to estimate and eliminate choices. Anytime that you multiply decimals, it is going to give an answer with the same number of decimal places as the combined operands.

So for example,

$2.38 \times 1.2$  will produce a number with three places of decimal, which is 2.856.

Here are a few examples with step-by-step explanation:

**Solve  $2.06 \times 1.2$**

- a. 24.82
- b. 2.482
- c. 24.72
- d. 2.472

This is a simple question, but even before you start calculating, you can eliminate several choices. When multiplying decimals, there will always be as many numbers behind the decimal place in the answer as the sum of the ones in the initial problem, so choices A and C can be eliminated.

The correct answer is D:  $2.06 \times 1.2 = 2.472$

**Solve  $20.0 \div 2.5$** 

- a. 12.05
- b. 9.25
- c. 8.3
- d. 8

First estimate the answer to be around 10, and eliminate choice A. And since it'd also be an even number, you can eliminate choices B and C, leaving only choice D.

The correct Answer is D:  $20.0 \div 2.5 = 8$

# How to Study for a Math Test

**E**VERY SUBJECT HAS ITS OWN PARTICULAR STUDY METHOD. Math is mostly numerical, rather than verbal, and requires logical thinking; it has its own way to be studied. Before touching on significant points of studying a math test, let's look at some of the fundamentals of "learning."

Learning is not an instant experience; it is a procedure. Learning is a process not an event. Rome wasn't built in a day, and learning anything (or everything) isn't going to happen in a day either. You cannot expect to learn everything in one day, at night, before the test. It is important and necessary to learn day-by-day. Good time management plays a considerable role in learning. When you manage your time, and begin test preparation well in advance, you will notice the subjects are easier than you thought, or feared, and you will take the test without the stress of a sleepless body and an anxious mind.

Memorizing is a temporary step of learning if information is not comprehended and applied afterwards. Memorize just the basics and understand the meaning; then apply, analyze, synthesize and evaluate.

These are the hierarchical layout of cognitive learning: Of course, there are some basic properties that you need to memorize in the beginning, since you cannot prove the facts every time you solve a math test. For example; the inner angles of a triangle sum up to  $180^\circ$ . If you do not know this, you may not

# How to Prepare for a Test

**M**OST STUDENTS HIDE THEIR HEADS AND PROCRASTINATE WHEN FACED WITH PREPARING FOR AN EXAM, HOPING THAT SOMEHOW THEY WILL BE SPARED THE AGONY, ESPECIALLY IF IT IS A BIG ONE THAT THEIR FUTURES RELY ON. Avoiding a test is what many students do best and unfortunately, they suffer the consequences because of their lack of preparation.

Test preparation requires strategy and dedication. It is the perfect training ground for a professional life. Besides having several reliable strategies, successful students also has a clear goal and know how to accomplish it. These tried and true concepts have worked well and will make your test preparation easier.

## **The Study Approach**

**Take responsibility for your own test preparation.**

It is a common - but big - mistake to link your studying to someone else's. Study partners are great, but only if they are reliable. It is your job to be prepared for the test, even if a study partner fails you. Do not allow others to distract you from your goals.

## **Prioritize the time available to study**

When do you learn best, early in the day or at night? Does your mind absorb and retain information most efficiently in small blocks of time, or do you require long stretches to get

# How to Take a Test

**E**VERYONE KNOWS THAT TAKING AN EXAM IS STRESSFUL, BUT IT DOES NOT HAVE TO BE THAT BAD! There are a few simple things that you can do to increase your score on any type of test. Take a look at these tips and consider how you can incorporate them into your study time.

OK - so you are in the test room - Here is what to do!

## Reading the Instructions

This is the most basic point, but one that, surprisingly, many students ignore and it costs big time! Since reading the instructions is one of the most common, and 100% preventable mistakes, we have a whole section just on reading instructions.

Pay close attention to the sample questions. Almost all standardized tests offer sample questions, paired with their correct solutions. Go through these to make sure that you understand what they mean and how they arrived at the correct answer. Do not be afraid to ask the test supervisor for help with a sample that confuses you, or instructions that you are unsure of.

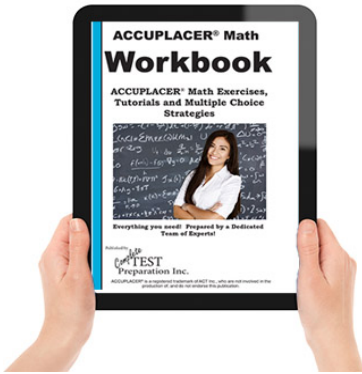
## Tips for Reading the Question

We could write pages and pages of tips just on reading the test questions. Here are a few that will help you the most.

- **Think first.** Before you look at the

**C**ONGRATULATIONS! You have made it this far because you have applied yourself diligently to practicing for the exam and no doubt improved your potential score considerably! Passing your up-coming exam is a huge step in a journey that might be challenging at times but will be many times more rewarding and fulfilling. That is why being prepared is so important.

Good Luck!



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