Preparing for the ACT Math Test

Math begins on page 145 of the ACT prep plus 2019 book

Facts about the test

The test is 60 minutes long and includes 60 questions.

All questions are multiple choice with 5 possible choices.

The test is primarily designed to test thinking skills rather than knowledge, although some knowledge is required. Topics are basic math concepts taught in a regular high school curriculum, ranging from pre-algebra and elementary algebra to plane geometry and a bit of trigonometry.

Prep studying strategy

- For test studying and general test taking strategy – read pages 149 starting with “The Inside Scoop” through page 153.
- Review pages 157 – 428 as needed help with individual math sections

Suggestion

If you have a very good grasp of the all subjects in the math section, then brushing up in the areas where you are less strong in makes sense.

If on the other hand, math is very tough for you and you have limited time to prepare, then focus on the areas that have the highest probability and frequency on the test per Kaplan’s pages 152-153 and focus your effort at being good at some or most of those areas. For instance, you might not want to spend much time on Statistics and Probability if you know little about that and you could spend the time on other areas to make a bigger impact on your math score.

Test directions

Do not take time to read them on test day

Solve easy problems first
Do not linger over problems that take too much time
You may use a calculator, but some problems may best be done without one.
Illustrative figures are not necessarily drawn to scale.
Geometric figures **lie** in a plane. (They are two dimensional.)
The word *line* indicates a straight line.
The word *average* indicates arithmetic mean.

Important tips!

Do not spend time on a question if you get stuck! Move on!

Plan to go through the test twice, doing the easy questions first. Make sure you get through the entire exam. Return to the harder problems in the second time through the questions. Plan to spend about 45 minutes on the first pass through of the test.

Look for the quickest way to solve problems. This requires creative thinking.

Use the answer choices to help you. If you are stuck, plug numbers in for variables or use the numbers in the answer choices to get to the right answer.

The answer "cannot be determined" is almost always wrong on the ACT Math Test

An unanswered question is always wrong, but even a wild guess may be right. There is no penalty for wrong answers. In fact a smart guess can make a big difference. Never leave a question blank!

Practice with your calculator so you are comfortable with it, but keep in mind that some problems are solved faster not using it. *For the most current information on the ACT calculator policy, visit* www.actstudent.org.

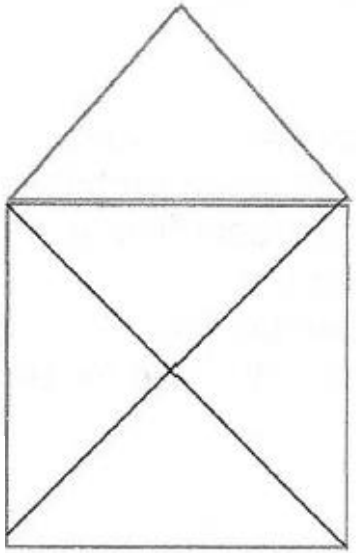
Problem 1

Page 147

About a third of the Math questions either give you a diagram or describe a situation that should be diagrammed. For these questions, the diagrams are crucial.

Problem 1:

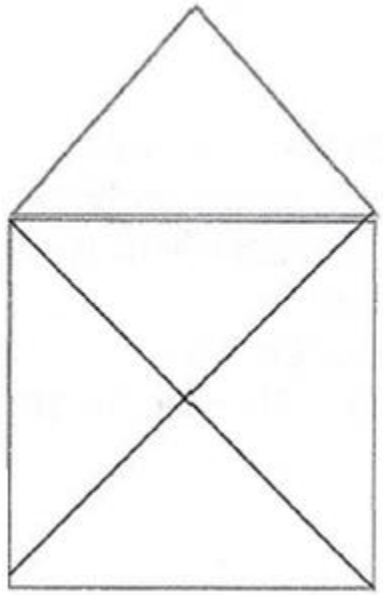
The figure below contains five congruent triangles. The longest side of each triangle is 4 meters long. What is the area of the whole figure?



What does congruent triangles mean?

A. 15 square meters
B. 20 square meters
C. 30 square meters
D. Cannot be determined from the information given

Problem 1 solution



4 meters

4 meters

When triangles are congruent they will have exactly the same three sides and exactly the same three angles. The equal sides and angles may not be in the same position (if there is a turn or a flip), but they are there. The area will be the same.

$4M \times 4M = 16\ m^2$

Area of triangle = $\frac{16}{4}\ m^2 = 4\ m^2$

A. 15 square meters
B. 20 square meters
C. 30 square meters
D. Cannot be determined from the information given

Area of 5 congruent triangles is

$5 \times 4\ m^2 = 20\ m^2$

Problem 2

About a third of the questions directly ask you to demonstrate your knowledge of specific math concepts.

If angles A and B are supplementary, and the measure of angle A is 57 degrees, what is the measure, in degrees of angle B?

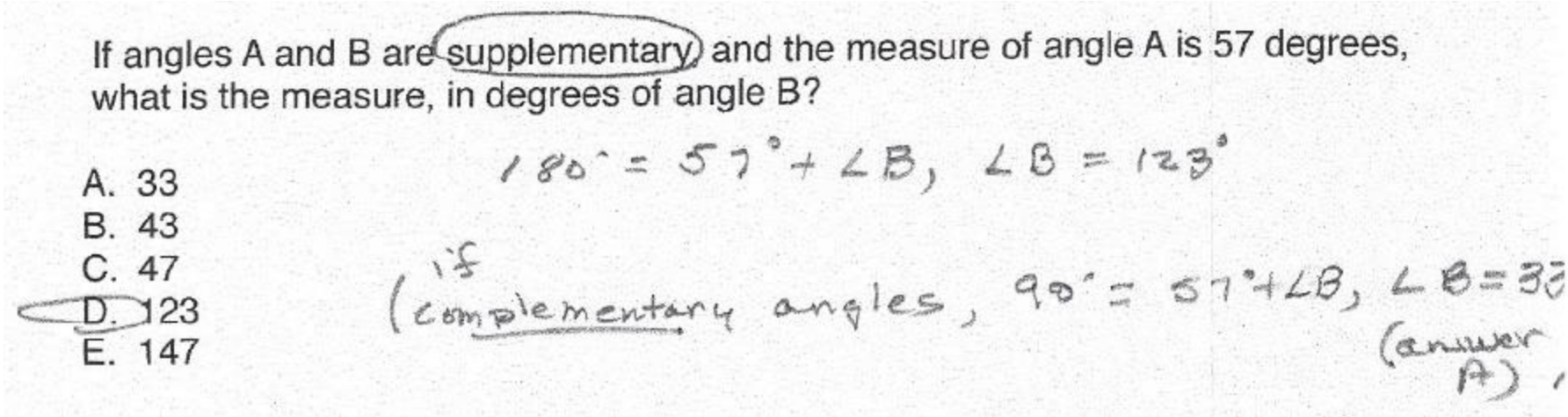
A. 33
B. 43
C. 47
D. 123
E. 147

What does supplementary angles mean?

Problem 2 solution

Two Angles are Supplementary when they add up to 180 degrees. They don't have to be next to each other, just so long as the total is 180 degrees. Examples:

- 60° and 120° are supplementary angles.
- 93° and 87° are supplementary angles.



Problem 3

about another third of the Math questions are story problems

Evan drove half way home at 20 miles per hour, then sped up and drove the rest of the way at 30 miles per hour. What was the average speed for the entire trip?

F. 20 miles per hour
G. 22 miles per hour
H. 24 miles per hour
J. 25 miles per hour
K. 28 miles per hour

Thoughts about how to solve this problem?

Problem 3 solution

A good way to solve a story problem like this is to think in terms of a real situation: what if Evan had 120 miles to drive?

Evan drove half way home at 20 miles per hour, then sped up and drove the rest of the way at 30 miles per hour. What was the average speed for the entire trip?

F. 20 miles per hour
G. 22 miles per hour
H. 24 miles per hour
J. 25 miles per hour
K. 28 miles per hour

1) $d_1 = d_2 = 60$ miles; use $r \cdot t = d$

2) $r_1 = 20$ mph, therefore $t_1 = \frac{d_1}{r_1} = 3$ hr

3) $r_2 = 30$ mph, therefore $t_2 = \frac{d_2}{r_2} = 2$ hr

4) $D_{TOTAL} = r_{TOTAL} \cdot t_{TOTAL}$, therefore Total $= D_{TOTAL}/t_{TOTAL} = \frac{120}{5} =$ 24 mph

Problem 4

What is the value of $3x$ if $9x = 5y + 2$ and $y + 4 = 2y - 10$?

F. 5
G. 8
H. 14
J. 24
K. 72

Problem 4 solution

Problem 4:

What is the value of 3x if 9x = 5y + 2 and y + 4 = 2y - 10?

F. 5
G. 8
H. 14
J. 24
K. 72

1) From second equation, solve for y: $y = 14$
2) substitute 14 for y in first equation, solve for $x = 8$
3) $3x = 24$

See … they were trying to mess with you… if you had stopped when you found x and picked G as your answer, you would have been wrong!

With every problem, make sure you **Answer the Right Question. Always check the question again before choosing your answer.**

Problem 5

If $3x^2 + 5 = 17$, which of the following could be the value of x?

A. -3
B. -2
C. 0
D. 1
E. 4

What's unusual about this problem?

Problem 5 solution

If $3x^2 + 5 = 17$, which of the following could be the value of x?

A. -3
B. -2
C. 0
D. 1
E. 4

$x^2 = 4$; $x = \pm 2$

They were messing with you again…
there are two possible answers!

On many ACT questions, the right answer is hidden in some way. Some questions have more than one possible right solution, though only one correct answer choice is given. The ACT may hide the answer by offering one of the less obvious answers to the question.

Problem 6

If a is an odd integer and b is an even integer, which of the following must be odd?

A. $2a + b$
B. $a + 2b$
C. ab
D. a^2b
E. ab^2

Thoughts about how to proceed?

Problem 6 solution

If a is an odd integer and b is an even integer, which of the following must be odd?

Pick numbers for a and b. let $a = 1$, $b = 2$

A. $2a + b = 4$
B. $a + 2b = 5$
C. $ab = 2$
D. $a^2b = 2$
E. $ab^2 = 4$

Sometimes you can get stuck on an algebra problem because it is too general or abstract. A good way to attack such a problem is to replace variables with numbers.

Problem 7

All 200 tickets were sold for a particular concert. Some tickets cost $10 apiece, and others cost $5 apiece. If the total ticket sales were $1,750, how many of the more expensive tickets were sold?

F. 20
G. 75
H. 100
J. 150
K. 175

How would you proceed to save time?

Problem 7 solution

With some ACT Math problems, it may actually be easier to try out each answer choice until you find one that works. This is called backsolving.

All 200 tickets were sold for a particular concert. Some tickets cost $10 apiece, and others cost $5 apiece. If the total ticket sales were $1,750, how many of the more expensive tickets were sold?

F. 20
G. 75
H. 100
J. 150
K. 175

$100(10) + (200-100)5 = \$1{,}500$ – too low.
$150(10) + (200-150)5 = 1{,}750$ – Done

You could solve for X or you could simply back solve quickly using a number in the middle of the range as shown

Backsolving may not be a method you would show your algebra teacher with pride, but all that matters is the right answer.

Problem 8

When 4/11 is converted to a decimal, the 50th digit after the decimal point is

A. 2
B. 3
C. 4
D. 5
E. 6

Would they really ask for much division time? Thoughts?

Problem 8 solution

When 4/11 is converted to a decimal, the 50th digit after the decimal point is

A. 2
B. 3
C. 4
D. 5
E. 6

$4/11 = .\overline{36}$, even decimal places are 6.
$\therefore$ 50th decimal place is 6

Be a thinker, not a number cruncher. Be on the lookout for quicker ways to solve problems.

No ACT Math problem should take more than a minute to solve. There has to be a faster way to solve this problem that carrying out the division to 50 decimal places. How about a *repeating* decimal?

Problem 9

The sum of all the integers fro 1 to 44, inclusive, is subtracted from the sum of all integers from 7 to 50, inclusive. What is the result?

F. 6
G. 44
H. 50
J. 264
K. 300

Again… would they really ask for that much addition and subtraction? Thoughts?

Problem 9 solution

The sum of all the integers fro 1 to 44, inclusive, is subtracted from the sum of all integers from 7 to 50, inclusive. What is the result?

F. 6
G. 44
H. 50
J. 264
K. 300

Do not sum 7 thru 50, then subtract sum 1 thru 44! Takes too long.

Solution $(7+8+9+\cdots+50)-(1+2+3+\cdots+44) =$

$6+6+6+\cdots+6$

$44 \times 6 = 264$

The good news is that you never absolutely need to use a calculator on the ACT. No Math questions requires messy or tedious calculations. But while the calculator can't answer questions for you, it can keep you from making computational errors on questions you know how to solve.

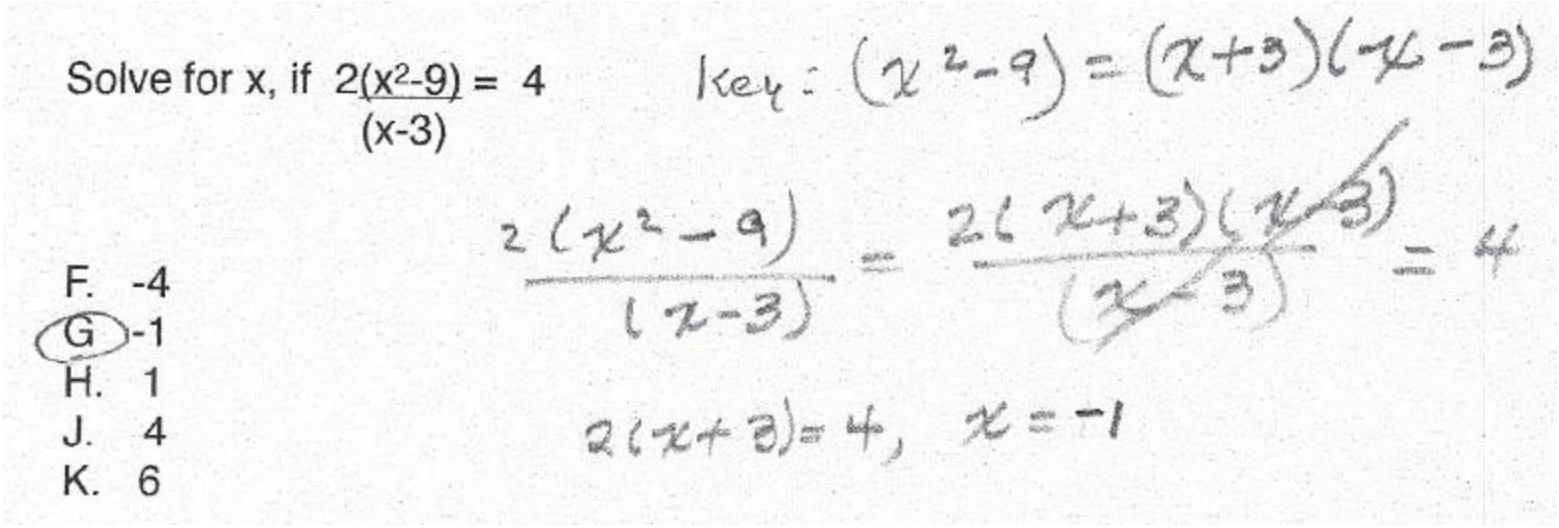
However, the calculator can cost you time if you overuse it. If a problem seems to involve a lot of calculation, look for a quicker way. Try to spot a pattern that will help you save some time.

Problem 10

Solve for x, if $\frac{2(x^2-9)}{(x-3)} = 4$

F. -4
G -1
H. 1
J. 4
K. 6

Problem 10 solution



If you didn't remember the polynomial key, as an alternative you could have simplified the equation to $x^2 = 2x + 3$. Since x^2 increases rapidly compared with 2x, you could have started substituting small number options like -1 and 1 to see if they work.

Problem 11

What are the (x,y) coordinates of the point of intersection of the line representing the equation $5x + 2y = 4$ and the line representing $x - 2y = 8$?

A. (2,3)
B. (-2,3)
C. (2,-3)
D. (-3,2)
E. (3,-2)

Problem 11 solution

What are the (x,y) coordinates of the point of intersection of the line representing the equation 5x + 2y = 4 and the line representing x - 2y = 8?

A. (2,3)
B. (-2,3)
C. (2,-3)
D. (-3,2)
E. (3,-2)

① $(5x + 2y = 4)$
$+ (x - 2y = 8)$
$6x = 12,\ x = 2$

② $5(2) + 2y = 4,\ 2y = -6,\ y = -3$

If you didn't remember the trick to add the two equations, you could have solved for x and substituted x for y:

X= 8 +2y 10y +40 +2y = 4 12 y = -36 y = -3

Problem 12

In a group of 250 students, 40 are seniors, What percentage of the group are seniors?

F. 1.6%
G. 6.25%
H. 10%
J. 16%
K. 40%

Problem 12 solution

In a group of 250 students, 40 are seniors, What percentage of the group are seniors?

F. 1.6%
G. 6.25%
H. 10%
J. 16%
K. 40%

40/250 = .16 or 16 %

Problem 13

If a jar contains 9 red balls, 7 green balls and 4 orange balls. If a ball is drawn by random, what is the probability that the ball is not orange?

A. 16%
B. 20%
C. 40%
D. 60%
E. 80%

Problem 13 solution

If a jar contains 9 red balls, 7 green balls and 4 orange balls. If a ball is drawn by random, what is the probability that the ball is not orange?

A. 16%
B. 20%
C. 40%
D. 60%
E. 80%

1) Total number of balls = 20
2) Total number of non-orange balls = 16
3) Thus P(ball not orange) = 16/20 = .80 or 80

Problem 14

Which of the following is equivalent to $7^{77} - 7^{76}$?

A. 7

B. 7^{77-76}

C. 7^{77+76}

D. 7(77-76)

E. $7^{76}(6)$

Problem 14 solution

Which of the following is equivalent to $7^{77} - 7^{76}$?

A. 7

B. 7^{77-76}

C. 7^{77+76}

D. 7(77-76)

E. $7^{76}(6)$

Tricky – use of exponents

1) $7^{77} = (7)(7^{76})$

2) $7^{77} - 7^{76} = (7)(7^{76}) - 7^{76} =$

$(7-1)(7^{76}) = (6)(7^{76}) = (7^{76})(6)$

Note that A, B, and D are all the same number ….7 and C is a really really really big number!

Problem 15

To earn a B for the semester, Linda needs an average of at least 80 on the five tests, Her average for the first four test scores is 79. What is the minimum score she must get on the fifth test to earn a B for the semester?

F. 80
G. 81
H. 82
J. 83
K. 84

Problem 15 solution

To earn a B for the semester, Linda needs an average of at least 80 on the five tests, Her average for the first four test scores is 79. What is the minimum score she must get on the fifth test to earn a B for the semester?

F. 80
G. 81
H. 82
J. 83
K. 84

1) $\frac{s_1 + s_2 + s_3 + s_4 + s_5}{5} \geq 80$

2) $s_1 + s_2 + s_3 + s_4 = (4)(79) = 316$

3) $\frac{316 + s_5}{5} \geq 80, \quad 316 + s_5 \geq 400, \quad s_5 \geq 84$

Problem 16

In a class of 10 boys and 15 girls, the boys' average score on the final exam was 80 and the girls' average score was 90. What was the average score for the whole class?

A. 83
B. 84
C. 85
D. 86
E. 87

Problem 16 solution

In a class of 10 boys and 15 girls, the boys' average score on the final exam was 80 and the girls' average score was 90. What was the average score for the whole class?

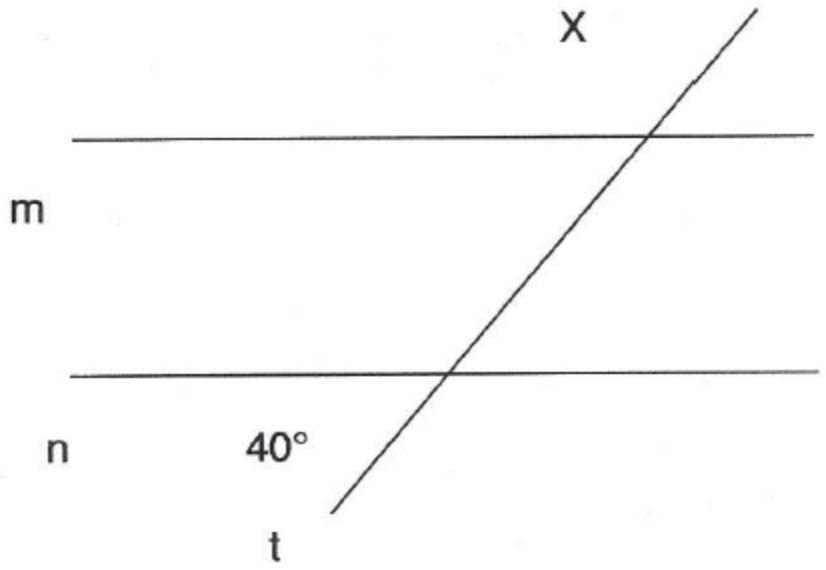
A. 83
B. 84
C. 85
D. 86
E. 87

Weighted average:

$$\frac{(10)(80)+(15)(90)}{25} = \frac{2150}{25} = 86$$

Problem 17

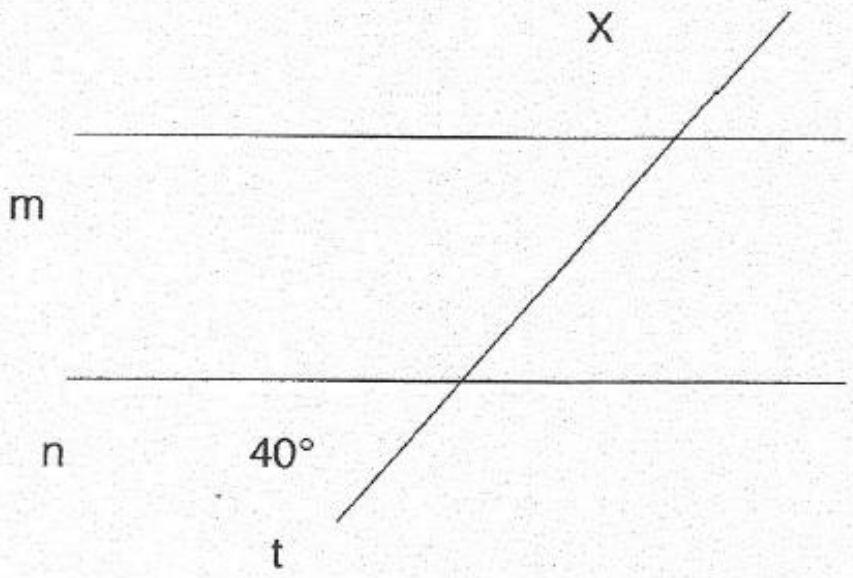
If the figure below, the line *t* crosses parallel lines *m* and *n*. What is the degrees of measure of angle *x*?



A. 40
B. 50
C. 60
D. 130
E. 140

Problem 17 solution

If the figure below, the line *t* crosses parallel lines *m* and *n*. What is the degrees of measure of angle *x*?



$180° - 40° = 140°$

A. 40
B. 50
C. 60
D. 130
E. 140

Problem 18

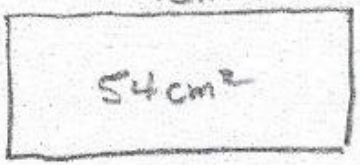
The length of a rectangle with area 54 square centimeters is 9 centimeters. What is the perimeter of the rectangle, in centimeters?

F. 6
G. 12
H. 15
J. 24
K. 30

Problem 18 solution

The length of a rectangle with area 54 square centimeters is 9 centimeters. What is the perimeter of the rectangle, in centimeters?

F. 6
G. 12
H. 15
J. 24
K. 30

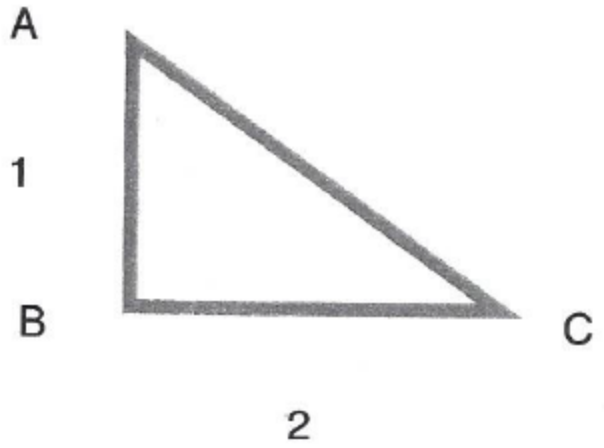
① 

Therefore $x = \frac{54cm^2}{9cm} = 6$

② Perimeter = $2(9cm) + 2(6m) = 30cm$

Problem 19

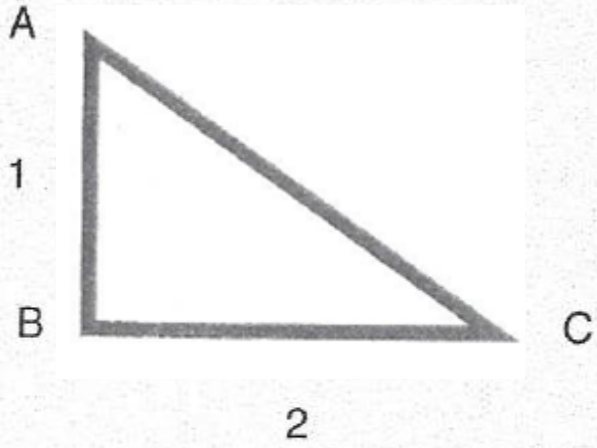
In Δ ABC below, angle B is a right angle. If AB is 1 unit long, and BC is 2 units long, how many units long is AC?



A. $\sqrt{3}$
B. $\sqrt{2}$
C. 2
D. $\sqrt{5}$
F. 3

Problem 19 solution

In Δ ABC below, angle B is a right angle. If AB is 1 unit long, and BC is 2 units long, how many units long is AC?



Use Pythagorean Theorem

$AB^2 + BC^2 = AC^2$

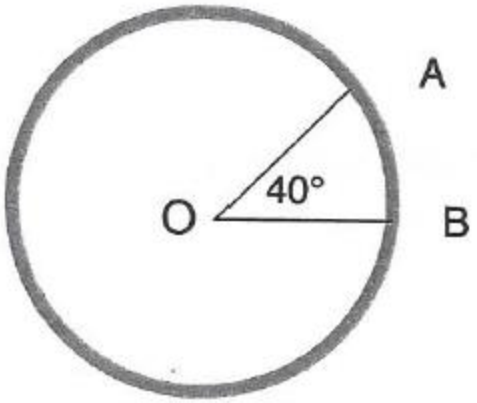
$1 + 4 = AC^2$, $AC = \sqrt{5}$

A. $\sqrt{3}$
B. $\sqrt{2}$
C. 2
D. $\sqrt{5}$
F. 3

Problem 20

In the circle centered at O in the figure below, the measure of ∠AOB is 40°. If OA is 9 units long. how many units long is minor arc AB?

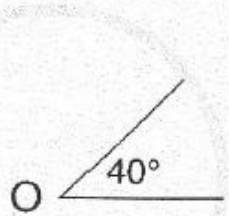
A. π
B. 2π
C. 9
D. 9π
E. 40



Problem 20 solution

In the circle centered at O in the figure below, the measure of ∠AOB is 40°. If OA is 9 units long. how many units long is minor arc AB?

A. π
B. 2π
C. 9
D. 9π
E. 40



1) $C = 2\pi r = 18\pi$

2) $\frac{\overset{\frown}{AB}}{C} = \frac{40^\circ}{360^\circ}$

$\overset{\frown}{AB} = \frac{(40)(18\pi)}{360} = 2\pi$

Problem 21

What is the value of $x^2 + 3x - 9$ when $x = -3$?

A. -27
B. -9
C. -6
D. 0
E. 9

Problem 21 solution

What is the value of $x^2 + 3x - 9$ when $x = -3$?

A. -27
B. -9
C. -6
D. 0
E. 9

Be careful of the signs

$(-3^2) + (3)(-3) - 9 = 9 - 9 - 9 = -9$

Problem 22

What is the greatest of the numbers?

A. 1^{50}
B. 50^{1}
C. 2^{25}
D. 25^{2}
E. 4^{10}

Problem 22 solution

What is the greatest of the numbers?

A. 1^{50} $= 1$

B. 50^{1} $= 50$

C. 2^{25}

D. $25^{2} = 625$ ($< 4^{10}$ by inspection)

E. 4^{10}

But what ab 2^{25} vs 4^{10}? $4^{10} = 2^{2 \cdot 10} = 2^{20} < 2^{25}$

Problem 23

Problem 23:

$$\frac{\sqrt{32} + \sqrt{24}}{\sqrt{8}} = ?$$

A. $\sqrt{7}$
B. $\sqrt{2} + \sqrt{3}$
C. $2 + \sqrt{3}$
D. $\sqrt{2} + 3$
E. 7

Problem 23 solution

Problem 23:

$$\frac{\sqrt{32} + \sqrt{24}}{\sqrt{8}} = ?$$

A. $\sqrt{7}$
B. $\sqrt{2} + \sqrt{3}$
C. $2 + \sqrt{3}$
D. $\sqrt{2} + 3$
E. 7

$$\frac{\sqrt{32} + \sqrt{24}}{\sqrt{8}} = \frac{\sqrt{32}}{\sqrt{8}} + \frac{\sqrt{24}}{\sqrt{8}} = \sqrt{\frac{32}{8}} + \sqrt{\frac{24}{8}} =$$

$$\sqrt{4} + \sqrt{3} = 2 + \sqrt{3}$$

Problem 24

The hypotenuse of a 30°-60°-90° triangle is 10 units long. What is the perimeter of the triangle to the nearest whole unit?

A. 5
B. 9
C. 13
D. 24
E. 28

What do we know about one side other than the hypotenuse of a 30-60-90 degree triangle?

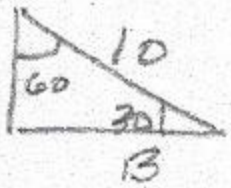
What do we know about the hypotenuse length compared with the length of either side?

Problem 24 solution

The hypotenuse of a 30°-60°-90° triangle is 10 units long. What is the perimeter of the triangle to the nearest whole unit?

A. 5
B. 9
C. 13
D. 24
E. 28

Draw diagram



Use trigonometry $\frac{A}{10} = \sin(30°) = .5$, $A = 5$

$\frac{B}{10} = \cos(30) = .87$, $B = 8.7$

$A + B + C = 23.7$

Or another way to look this problem given that it is a 30-60-90 degree triangle….
One side is ½ the length of the hypotenuse so the answer has to be greater than 15
Neither other side will be as long as the hypotenuse so the answer has to be less than 25.

Recapping important tips!

Plan to go through the test twice, doing the easy questions first. Make sure you get through the entire exam. Return to the harder problems in the second time through the questions.

Look for the quickest way to solve problems. This requires creative thinking.

Use the answer choices to help you. If you are stuck, plug numbers in for variables or use the numbers in the answer choices to get to the right answer.

The answer "cannot be determined" is almost always wrong on the ACT Math Test

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Other comments

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An unanswered question is always wrong, but even a wild guess may be right. On the ACT, a guess can't hurt you. There is no penalty for wrong answers. In fact a smart guess can make a big difference. Never leave a question blank!

The ACT exam scores are scaled from 1 to 36. For the national average score of 20, you need to answer only about 53% of the questions correctly. A score of 23 corresponds to about 63% of the questions answered correctly and a percentile rank of 76%.

You do not need 90% or more correct answers to do well on this exam. Just 2 right out of 3 gets you a great score!

Keep your cool!

Good luck with the test!