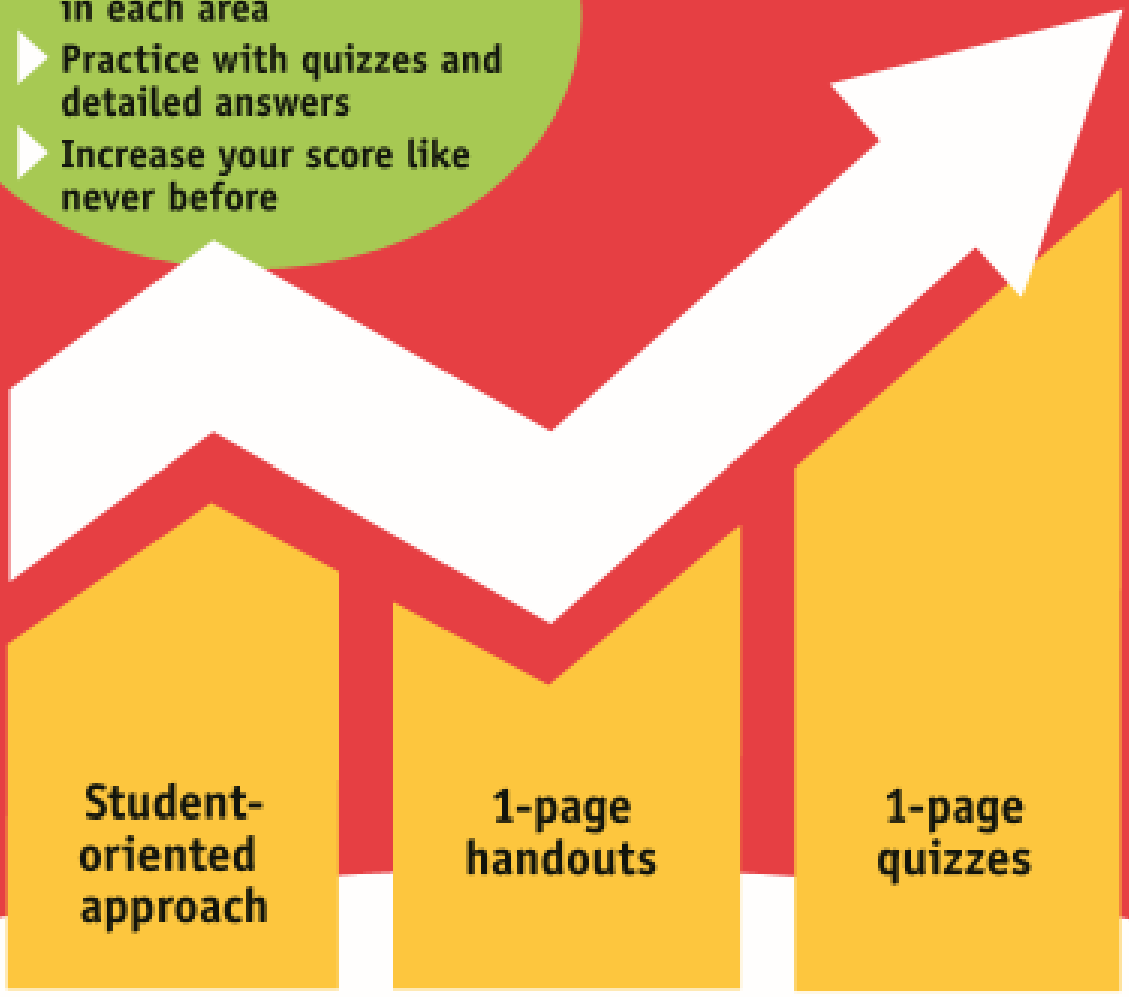
Analyze your ACT

By Winni van Gessel

- Quickly pinpoint areas for improvement
- Review 1-page handouts in each area
- Practice with quizzes and detailed answers
- Increase your score like never before



Immediate, Precise Feedback

"Thousands of students have used this approach with immediate success!"

Analyze Your ACT
Winni van Gessel

2 Full Tests
150 Worksheets

THE ACT TESTS YOUR SKILLS

Let's work on skills, instead of working on tests!

INNOVATIVE APPROACH

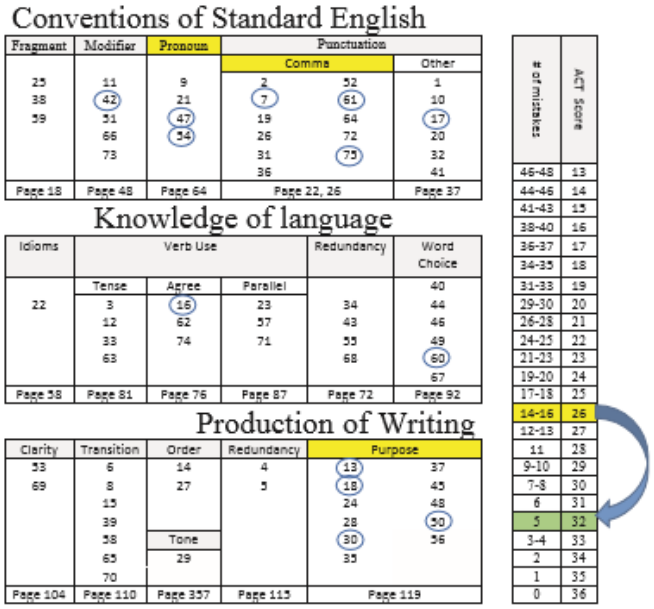
Analyze your ACT starts with an analysis of your test to indicate which skills you need to improve and provides worksheets to master those areas. While the book includes four full tests, its focus remains on a manageable approach to keep students motivated to work on their skills.

FIND OUT WHAT TO STUDY

This book is organized by areas that mimic the content of the ACT. Once you know in which area you made your mistakes, this book provides one-page worksheets to gain the needed knowledge and practice. More importantly, it will reveal the traps and curveballs in the ACT and the best ways to solve complicated problems. Watch for over 400 tips and rules in this book. (Look for the 👀 throughout the chapters.)

PRACTICE TEST-TAKING SKILLS

This book teaches you test-taking skills that make a measurable difference in results. It includes numerous exercises to decrease mistakes from one worksheet to the next. Use the suggested skills to approach the test with confidence and experience. Once you are aware of what holds you back, you will learn to make it a habit to use these new skills not only during the ACT, but in college as well!



Conventions of Standard English

Fragment	Modifier	Pronoun	Punctuation		
			Comma		Other
25	11	9	2	52	1
38	(42)	21	(7)	(61)	10
39	51	(47)	19	64	(17)
	66	(54)	26	72	20
	73		31	(75)	32
			36		41
Page 18	Page 48	Page 64	Page 22, 26		Page 37

Knowledge of language

Idioms	Verb Use			Redundancy	Word Choice
	Tense	Agree	Parallel		40
22	3	(16)	23	34	44
	12	62	57	43	46
	33	74	71	55	48
	63			68	(60)
					67
Page 58	Page 81	Page 76	Page 87	Page 72	Page 92

Production of Writing

Clarity	Transition	Order	Redundancy	Purpose	
33	6	14	4	(13)	37
69	8	27	5	(18)	45
	15			24	48
	39			28	(50)
	58	Tone		(30)	56
	65	29		35	
	70				
Page 104	Page 110	Page 357	Page 115	Page 119	

# of mistakes	ACT Score
46-48	13
44-46	14
41-43	15
38-40	16
36-37	17
34-35	18
31-33	19
29-30	20
26-28	21
24-25	22
21-23	23
19-20	24
17-18	25
14-16	26
12-13	27
11	28
9-10	29
7-8	30
6	31
5	32
3-4	33
2	34
1	35
0	36

Master three areas to gain 6 points! Trendsheets provide a visual overview of areas in need of improvement to help students set achievable goals.

FINALLY! TECHNIQUES FOR READING AND SCIENCE

From inference and purpose questions to graphs, tables, and experiments, this book provides one-page exercises and drills to learn step by step how to get better in specific areas. Less than five minutes at a time, these worksheets can keep the attention of any student!

Winni's method helped me address my weak points that I didn't know I had. This approach is much more effective than completing test after test with the same results. I raised my score by 4 points and received considerable scholarships because I was able to pinpoint what I needed to work on.

Winni's ACT method was by far the most efficient I've ever used. It broke the ACT down into less intimidating parts and gave me the time-management and problem-solving skills to conquer it. My score went up in no time, and I am going to college for free!

The ACT tips in this book were very personalized, which helped target the exact areas where I was struggling. The worksheets took minutes at a time and helped me study in between my numerous activities. My score went up 4 points because of the short-term goals that I was able to set for myself.

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First Edition

About the Author: Winni van Gessel

Originally from the Netherlands, Winni has taught students of all ages in Lexington, KY, from Pre-K to graduate students. He has been a Montessori guide and headmaster, a soccer coach, and a motivational speaker. He has also taught study skills to hundreds of students across the United States. Winni is an owner and college planner at Class101. He helps families and students save tens of thousands of dollars of college tuition by analyzing standardized tests, scrutinizing essays, and pursuing the best colleges and scholarships.

Winni has an M.Ed. in Educational Policies and Evaluation from the University of Kentucky, where he continued his doctoral studies in Instructional Design. His passion for education and his boundless energy enable Winni to focus on the unique needs of his scholars who have inspired him to create individualized tools for their success.

Winni lives in Lexington with his wife, Ania, and their two daughters, Corrie and Veronica. The girls were the reason that Winni became interested in the conundrums of the ACT, and they have both been willing pioneers of Winni's worksheets and exercises. The whole family has been an essential ingredient in the creation of this book.

TABLE OF CONTENTS (PARTS IN BLUE ARE IN THIS PREVIEW)

How To Use This Book 1
TRENDSHEETS 3
ENGLISH 15
CONVENTIONS OF ENGLISH
Sentence Structure 18
Comma Usage - One Comma 22
Comma Usage - Two Commas 26
Punctuation - Semicolons & Colons 32
Hyphens and Dashes 37
The Apostrophe 39
Modifiers 48
Idioms 58
Pronouns 64
KNOWLEDGE OF LANGUAGE
Redundancy in Sentences 72
Verb-Subject Agreement 76
Verb Tense 81
Parallel Structure 87
Word Choices 92
Grammar Quizzes 95
English Grammar Overview 101
PRODUCTION OF WRITING
Clarity 104
Conjunctions 108
Transitions 110
Redundancy in Paragraphs 115
Purpose Questions - Main Idea 119
English Test 1 122
English Test 2 142
MATH 161
ESSENTIAL SKILLS
Fractions 164
Percentages 170
Averages 174
Ratios 182
NUMBER & QUANTITY
Factoring 186
Sequences 190
Exponents and Roots 194
Irrational/Imaginary Numbers 198
ALGEBRA
Simple Equations 202
Absolute Value 206
Quadratic Equations 210
Translations (Word Problems) 218
GEOMETRY
Basic Shapes 222
Angles and Triangles 228
Special Triangles 231
Pythagorean Theorem 237
Circles 240
Polygons 248
The Coordinate Plane 252
FUNCTIONS 254
Linear Equations 258
Trigonometry Review 262
Logic 274
STATISTICS
Probability 278
Graphs 282
Logarithms 286
THE BEAST 293
Math Test 1 296
Math Test 2 316
READING 333
The Three Parts of the Reading Test 334
Reading Part I - The Text 335
One-Minute Speed Reading Test 336
Top 10 Reading Strategies 337
Reading Precisely 338
Reading Part II - The Questions 345
Clarity 347
Inference Questions 349
Word Choice - Vocab in Context 354
Tone of Voice 357
How to Find the Main Idea 359
Reading Part III - The Answers 361
The Fake 362
The Switch 364
The Extreme 366
The General 368
Reading Tips - What To Do 370
Reading Test 1 373
Reading Test 2 389
SCIENCE 405
Tables 408
Graphs - Overview 426
Graphs - Test-taking Skills 427
Research Summaries (Experiments) 442
Conflicting Viewpoints 450
Science Test 1 459
Science Test 2 479

How To Use This Book

1) Take a test provided by the ACT. Download 1267C or 1572C from the web. The ACT has made those tests available for free, although it does NOT do a very good job of helping you to figure out what you are doing wrong.
2) Mark the wrong answers on the trendsheets. (page 7-17) Count your mistakes to find your score.

   (For additional trendsheets, see our website www.analyzeyouract.com. Our website has numerous trendsheets from tests in popular books as well as from many official ACTs in the past)
3) Analyze your ACT by finding areas in which you made several mistakes. These are your *trends*. Determine how many areas you need to address to increase your score by three points, an achievable goal for a motivated student.
4) Study the handouts on the pages as indicated under each box on the trendsheet.
5) Practice with the quizzes that are provided after each handout. Aim for mastery.
6) Revisit the test questions that you missed previously in this area. Did you spot the correct answer this time? Having newly-developed skills can help!
7) Repeat steps 3-6 with any other subject from the trendsheet. Work top to bottom.
8) Finally, once you have mastered several new concepts, take another test (see the end of each chapter.) Analyze that test with the provided trendsheet. Are you still making the same mistakes? If you followed the above steps closely, you should have "improved your score like never before!"

Winni van Gessel

TRENDSHEETS

The trendsheets in this book give you very precise feedback about your skills and your weaknesses. Use the trendsheets to help you set a goal. Find out how many errors you need to address to improve three points on your next test. Then, find the areas of your choice on the trendsheet that add up to the number of errors you want to address, and work on the pages in the book as indicated.

If you use your trendsheets as a guideline, you will find out where you went wrong and how to avoid those mistakes during your next test.

1) Mark your score on the right side of the trendsheet.
2) Circle the questions you missed.
3) Find your trends (categories with the most mistakes.)
4) Set a goal: How many mastered categories will lead to a 3-point improvement?
5) Study the pages in this book that will help you master the required skills.
6) Review your missed questions.

SAMPLE TRENDSHEET

Conventions of Standard English

Fragment	Modifier	**Pronoun**	Punctuation		
			Comma		Other
25	11	9	2	52	1
38	(42)	21	(7)	(61)	10
59	51	(47)	19	64	(17)
	66	(54)	26	72	20
	73		31	(75)	32
			36		41
Page 18	Page 48	Page 64	Page 22	Page 26	P. 32

Knowledge of language

Idioms	Verb use			Redundancy	Word choice
	Tense	Agree	Parallel		
22	3	(16)	23	34	40
	12	62	57	43	44*
	33	74	71	55	46
	63			68	49
					(60)
					67
Page 58	Page 81	Page 76	Page 87	Page 72	P. 92

Production of Writing

Clarity	Transition	Order	Redundancy	**Purpose**	
53	6	14	4	(13)	45
69	8	27	5	(18)	48
	15			24	(50)
	39			28	56
	58			(30)	
	65			35	Tone
	70			37	29
Page 104	Page 108		Page 115	Page 119	P. 357

#mistakes	ACT Score
46-48	13
44-46	14
41-43	15
38-40	16
36-37	17
34-35	18
31-33	19
29-30	20
26-28	21
24-25	22
21-23	23
19-20	24
17-18	25
14-16	**26**
12-13	27
11	28
9-10	29
7-8	30
6	31
5	32
3-4	33
2	34
1	35
0	36

Setting a goal of increasing your score by three points is a good short-term objective. Focusing on just **two areas** will help you to achieve this. Going from a 26 to a 32? That is possible when you master three concepts: **commas, pronouns, and purpose questions**. This book will help you to overcome your trends.

SAMPLE TRENDSHEET

Conventions of Standard English

Fragment	Modifier	Pronoun	Punctuation		
			Comma		Other
25	11	(9)	2	(52)	1
38	(42)	(21)	(7)	(61)	10
59	51	(47)	19	(64)	(17)
	(66)	(54)	(26)	72	20
	73		31	(75)	(32)
			(36)		(41)
Page 18	Page 48	Page 64	Page 22	Page 26	Page 32

Knowledge of language

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	(33)	74	71	(55)	46
	63			68	49
					(60)
					67
Page 58	Page 81	Page 76	Page 87	Page 72	Page 92

Production of Writing

Clarity	Transition	Order	Redundancy	Purpose	
53	6	14	4	13	45
(69)	8	(27)	5	18	48
	(15)			24	(50)
	39			28	56
	58			(30)	
	(65)			(35)	Tone
	70			37	29
Page 104	Page 108		Page 115	Page 119	Page 357

#mistakes	ACT Score
46-48	13
44-46	14
41-43	15
38-40	16
36-37	17
34-35	18
31-33	19
29-30	20
26-28	**21**
24-25	22
21-23	23
19-20	24
17-18	25
14-16	26
12-13	27
11	28
9-10	29
7-8	30
6	31
5	32
3-4	33
2	34
1	35
0	36

Setting a goal of increasing your score by three points is a good short-term objective. Focusing on just **two areas** will help you to achieve this. Going from a 21 to a 26? That is possible when you master three concepts: **Commas, other punctuation, and pronouns**. This book will help you to overcome your trends.

Math-ACT

1572CPRE (ACT 2015 – 2016)

Name: _____ Date: _____

Mistakes: _____ ACT Score: _____

Essential Skills Number & Quantity

Fractions, %	Average	Ratio	Irrational Imaginary	Roots & Exponents	Sequence	Factoring
6						
18	2	3	29	19	7	
21	10	33		22	16	
25	37	51		48		
32						
43						
56						
P. 164, 170	Page 174	Page 182	Page 198	Page 194	Page 190	Page 186

Algebra Geometry

Simple Equations	Quadratic Equation	Translation	Coordinates	Polygons	Circles	Triangles
		15	40	9	14	13
4	24	35	44	12	49	17
23		54		34		20
52				41		26
58				46		27
				50		
				53		
Page 202	Page 206	Page 218	Page 252	Page 248	Page 240	Page 222

Functions Stats and Probability

Logic	Trig	Functions	Linear Equations	Tables & Graphs	Other	Probability
						1
	30	5	39	8	45	31
	57	11		28	55	43
	60	42		36		47
				38		55
						59
Page 274	Page 262	Page 254	Page 258	Page 282	-	Page 278

# of mistakes	ACT Score
50-52	13
48-49	14
41-43	15
38-40	16
37-39	17
34-36	18
32-33	19
31	20
29-30	21
27-28	22
25-26	23
23-24	24
21-22	25
14-16	26
12-13	27
13-15	28
11-12	29
9-10	30
7-8	31
6	32
4-5	33
3	34
1-2	35
0	36

1) Mark your score on the right. Circle the questions you missed. **2)** Find your trends (categories with the most mistakes.) Set a goal: How many mastered categories will lead to a 3-point improvement? **3)** Study the pages in this book that will help you master the required skills. **4)** Review your missed questions.

Comma Usage - One Comma

Commas can save lives!	
Let's eat Grandpa!	Let's eat, Grandpa!

If there is ONE comma in a sentence, the sentence structure most often follows one of the following rules:

Two Equal Adjectives

If a sentence has two adjectives of equal status describing the same noun, **put a comma** in between the adjectives. (Equal status means you can put "and" in between the adjectives or you can reverse the order.)

We had a nice, relaxing vacation. - You can say "a nice and relaxing vacation."
We had a wonderful winter break. - You can't say "a winter wonderful break."

Tip: Do not put a comma between the final adjective and the noun!

Introduction (Time, Place, and How)

Some sentences start with an introduction that describes the time, place, or manner in which a sentence takes place.

Always **put a comma** after the introduction. Introductions can be left out entirely, leaving a complete sentence.

Yesterday, I went to the mall. - Comma after the time introduction
In my hometown, we have only three traffic lights. - Comma after the place introduction
Growing up in the South, I ended up with a distinct accent. - Comma after the how introduction

Tip: Do not use a comma if the introduction is not at the beginning of the sentence!

FANBOYS

Two complete sentences can be combined with a conjunction, but you **ONLY put a comma** before the conjunction if you use one of the "**FANBOYS**" conjunctions **(F**or, **A**nd, **N**or, **B**ut, **O**r, **Y**et, **S**o**)**.

Melissa studied for her test and got an A in English. **No comma:** not two complete sentences
Melissa studied for her test, and she got an A in English. **Comma:** two complete sentences plus fanboys
Jerry went to the restaurant, for he was hungry. C**omma**: two complete sentences plus fanboys
Jerry went to the restaurant because he was hungry. **No comma**: two complete sentences – no fanboys

Tip: With other conjunctions, or when the part after the FANBOYS does not have a subject, do not use a comma!

Arnold organized his office and finally cleaned out his files. **No comma**: not two complete sentences
Clemens visited an art fair since he wanted to buy a sculpture. **No comma**: Two sentences - no fanboys
René wanted to save money; thus he did the work himself. **No comma**: Two sentences - no fanboys

CONTRAST

If there is a contrast between two concepts in one sentence, **use a comma** to emphasize the dissimilarity.

I like peanuts, not peanut butter.
You like cream in your coffee, don't you?
Anna has a great artistic skill, unlike her husband.

Commas - Quiz 1 (FANBOYS)

1. **A.** She ate her sandwich, and then took a nap.
   B. She ate her sandwich, then took a nap.
   C. She ate her sandwich and then took a nap.
   D. She ate her sandwich and then, took a nap.

2. **A.** Jennifer read the information carefully and she put the bed frame together quickly.
   B. Jennifer read the information carefully, and she put the bed frame together quickly.
   C. Jennifer read the information carefully and, she put the bed frame together quickly.
   D. Jennifer read the information carefully and she put the bed frame together, quickly.

3. **A.** Laura did not read the information carefully and could not put the bed frame together well.
   B. Laura did not read the information carefully, and could not put the bed frame together well.
   C. Laura did not read the information carefully and, could not put the bed frame together well.
   D. Laura, did not read the information carefully, and could not put the bed frame together well.

4. **A.** I do not like lifting weights nor do I, enjoy running on the treadmill.
   B. I do not like lifting weights nor do I enjoy running, on the treadmill.
   C. I do not like lifting weights, nor do I enjoy running on the treadmill.
   D. I do not like lifting weights nor, do I enjoy running on the treadmill.

5. **A.** Maya received 20% off when she purchased a computer but she could not use her coupon as well.
   B. Maya received 20% off when she purchased a computer, but she could not use her coupon as well.
   C. Maya received 20% off when she purchased a computer but, she could not use her coupon as well.
   D. Maya received 20% off, when she purchased a computer but she could not use her coupon as well.

6. **A.** We will help you improve your grades, if you come to our tutoring sessions each Friday.
   B. We will help you improve your grades if you come, to our tutoring sessions each Friday.
   C. We will help you improve your grades if you come to our tutoring sessions, each Friday.
   D. We will help you improve your grades if you come to our tutoring sessions each Friday.

7. **A.** Ed got an excellent price when he purchased a new computer for he did a lot of research.
   B. Ed got an excellent price, when he purchased a new computer for he did a lot of research.
   C. Ed got an excellent price when he purchased a new computer for, he did a lot of research.
   D. Ed got an excellent price when he purchased a new computer, for he did a lot of research.

8. **A.** Would you like to see a movie, or would you rather go bowling downtown?
   B. Would you like to see a movie or, would you rather go bowling downtown?
   C. Would you like to see a movie or would you rather go bowling downtown?
   D. Would you like to see a movie or would you rather go bowling, downtown?

9. **A.** She did not save enough money so she could not buy the latest iPhone, when I bought mine.
   B. She did not save enough money so, she could not buy the latest iPhone when I bought mine.
   C. She did not save enough money so she could not buy the latest iPhone when I bought mine.
   D. She did not save enough money, so she could not buy the latest iPhone when I bought mine.

10. **A.** She wanted to stay after school, because she had organized a study group with her friends.
    B. She wanted to stay after school because she had organized a study group with her friends.
    C. She wanted to stay after school because, she had organized a study group with her friends.
    D. She wanted to stay after school because she had organized a study group, with her friends.

1) C	2) B	3) A	4) C	5) B	6) D	7) D	8) A	9) D	10) B

Verb-Subject Agreement

I. "The boys run" and "one of the boys runs"

Singular subjects go with singular verbs; plural subjects go with plural verbs.
However, both underlined sections above are correct. The trick is not to look at the plural noun but to spot the real subject. When it says, ".. **of** the boys", something else must be the subject, not the boys.
"One of the boys…." The subject is one (of them). "One (boy)….." The subject is a singular noun.

1) The value of the numbers on these spreadsheets is/are important.
2) The treatment with several types of medicines is/are essential for a quick recovery.

II. Sentences with either, neither, or none (of)

3) "Either of the flowers is/are red."
4) "Neither of the boys is/are coming."
5) "None of my friends is/are on my soccer team."

Tip: Either and neither and none are ***singular***. (Think: "neither ONE of the boys *is* …" "Not ONE of my friends *is*)

III. Sentences with each

6) Each of my brothers have/has bought a car.
7) Each of my parents is/are against my going to the prom with Jake.

*Tip: Each is singular. (*Think "each ONE of my parents *is …. ")*

IV. Sentences with everybody

8) Should I say "Everybody loves their teacher" or "Everybody loves his or her teacher"?

Tip: "Everybody" and "Everyone" are singular words! Do not use these words with "they" or "their".
Other words that are always singular: Somebody, Anybody, Nobody, Everybody, Someone, Anyone, No one, Everyone, Something, Anything, Nothing, Everything and None,

V. Sentences with a group word (a collective noun)

The team, the committee, the family, the group, the herd, the audience, the majority: All singular words!

9) The group of boys is/are coming to my house.
10) The herd of wild and dangerous buffaloes is/are crossing the river.

Tip: Go to the beginning of the sentence. It is about a group (ONE group, ONE herd!) The subject is singular!

VI. Sentences with added information between the subject and verb

11) The opinion of the politicians, who are just like kings and rulers of the past, is/are not subjective.
12) The group of boys, that caused many problems during numerous parties, is/are coming to my house.
13) Anthony Davis, along with all the other UK basketball players, is/are celebrating the victory.

Tip: Ignore all information between two commas.
This added information makes you think about plural nouns and distracts you from the actual singular subject: the group.

1) is 2) is 3) is 4) is 5) is (*None –not one- is singular)* 6) has 7) is 8) his or her 9) is 10) is 11) is 12) is 13) is

Verb-Subject Agreement - Quiz 1

If a sentence is incorrect, find the error:

1. A pound of oranges, just like peaches and strawberries, are getting more expensive each week.
2. The donuts look great, and the batch of cookies on the counter smell delicious as well.
3. The display of 542 different colors in the paint store appear overwhelming.
4. One of the motives for his volunteer work are that he has too much free time.
5. The crowd of boys, who have created havoc at many parties, are coming to my house tonight.
6. Be careful with that pair of scissors. I just sharpened them.
7. A majority of the students has not studied for the test.
8. Here is your coat, but where is your scarf and your hat?
9. In the second paragraph of your paper is a spelling mistake and a missing quotation mark.
10. My mom, as well as my dad, are against the mayor's proposal.
11. All the players of the volleyball team and the coach has received an award.
12. The hardest part of our English test were the multiple-choice questions.
13. I need a new pair of glasses. I will call the optician to ask about their price.
14. The swimmer had a nice set of abs. He told me he trained daily to condition it.
15. I like to thank my coaches and teachers. Each were an important part of my success.
16. Geometric patterns are a characteristic of art forms in Moroccan architecture.
17. Too many injuries gives football a bad reputation among college sports.

Answer: 1) a pound is getting 2) *the batch smells* 3) the display appears 4) one of the motives is 5) the crowd is coming 6) I sharpened it (the pair) 7) correct: The majority has 8) Your scarf and your hat are here_9) Two mistakes are found in your paragraph 10) My mom is_against it. 11) The players and the coach have received 12) The hardest part was 13) I ask about its price 14) correct as written 15) Each (one of them) was an important part. 16) Correct as written 17) Injuries give football a bad reputation

English Grammar Overview Worksheet

who or whom?
→ →
Use "whom" after a ____

because –
due to –

fewer -
less -
number -
amount -

it's
its

lie – _____ - _____
lay – _____ - _____

Always use in pairs:
either _____
neither _____
not only _____

between **each other**
among **one another**

affect =
effect =

The four comma rules

1)
1)
2)
3)
One more rule:

Subject-verb agreement

Either & neither & none→
Each and Everybody → (don't use with ….)
Watch out for the word _____

Colon and semicolon

: _____
;

Parallelism

Use in _____, _____ and _____
Make sure all _____have the same ____
Compare two items very _____
When comparing *two* people, don't use ___ or ____

Verb tense

If an event in the past takes place before another event in the past, use _____ + _____
If the event happened in the past and is still going on, use _____ + _____

Redundancy

If in doubt, _____
Pick the _____ answer.

Conditional

Do not put _____and _____ in the same clause.

Modifier

A modifier describes only _____
_____
Dangling rule: everything before the comma refers to _____

Gerund

Watch out for words that end on _____
Without the _____, it is often a _____!

Pronouns. ● Pronouns refer to _____ in the _____. ● Do not ____ pronouns. ● Check the meaning of words such as _____and _____. ● Use _____ pronouns: I am taller than ___ . ● Don't use _____ in a general way ● Do not use a pronoun when _____ .

ENGLISH

Production of Writing

CLARITY

Some questions in the ACT evaluate your knowledge of the English grammar rules. Others evaluate how well you pay attention.

If you read the question very carefully, It is clear that only one answer actually answers what the question is asking for.

This test-taking technique will come handy throughout all portions of the ACT.

Redundancy in Paragraphs

For most students, the English part of the ACT does not have the time pressure that is a problem for many in the Math, Science, and Reading parts. Instead of skipping from question to question, you actually have time to read the rest of the passage, and you should!

Redundancy = Repeated Information **(see page 72)**

The ACT likes to hide redundant information in a paragraph. The sentence with the underlined part may be grammatically correct, but the information is repeated.

Tip: Don't skip from question to question; read the whole text.

> **Example**: Kneeling in church, Amy prayed for her mother, who was in the hospital. Her mom was undergoing a critical operation, and the doctors had warned about possible complications. Worried, Amy had crossed the street to the small church in front of the hospital. Now she was keeping her eyes closed, praying <u>on her knees,</u> and asking for a small miracle.

If you have a habit of only reading the underlined part of the test, you might not have caught the redundant part in the paragraph above: If you are kneeling, then you are already on your knees.

> **Example**: Winni was born and raised in the Netherlands. He learned English in his foreign-language classes during high school. Afterwards, he used his English when he traveled. His knowledge of English was crucial when Winni wanted to attend university classes in the USA. It is ironic that Winni, <u>who is from the Netherlands</u>, now teaches English grammar to native speakers.

Luckily, the ACT often gives its secrets away in its answers: "What should the author do with the underlined part of the sentence?"

> **A.** Keep it, because it adds an interesting detail to the paragraph.
> **B.** Keep it, because only people from the Netherlands learn English as a foreign language.
> **C.** Remove it, because it has nothing to do with the main idea of the paragraph.
> **D.** Remove it, because the information has already been mentioned in the paragraph.

Tip: Whenever you see an answer that is similar to answer D above, check the earlier sentences.
Or, as suggested before, make it a habit to read all information in the English test. You probably have enough time, and reading every detail will help you with your rhetorical skills.

> **Example**: Originally, Betsy had wanted to retire after 33 years in the classroom. She was looking forward to reading good books and taking long walks. She did not have plans to start a second career <u>initially</u>. However, when she was offered an exciting position as a Director of Franchise Relations in a growing company, she could not refuse.

The ACT is notorious for is emphasis on concise language. Whenever you have a chance to "delete the underlined portion of the text," pay attention! If the sentence or the meaning of the text does not change significantly, leave it out. If the information is already stated elsewhere (*originally* means the same thing as *initially,*) leave it out.

Tip: When in doubt, leave it out.

Redundancy in Paragraphs - Quiz 1

1. Savanah had waited weeks for the big event. She had stood in the first row during the whole concert. The lead singer had actually reached out and touched her. After the last song, Savanah had waited in vain for an hour to get a glimpse of the group at the backdoor of the theater. Being unsuccessful, she finally called her dad around midnight to come and pick her up. It had not broken her spirit though; she was still humming all the tunes when she walked through her front door.

   A. NO CHANGE
   B. Before heading home,
   C. In the end,
   D. Delete the underlined portion of the text, starting the sentence with She and capitalizing accordingly.

2. "Occasionally, we get large swarms of locusts on our farm," said Jim Trout, an organic farmer. He refused to spray pesticides, even though animals would sporadically eat a significant percentage of his crop. "It does not happen frequently." His wife concurred: "We have tried to discourage the locusts by keeping soil covers, but there is no effective way to keep them away. I guess it is just nature's way."

   A. NO CHANGE
   B. "They do not visit often."
   C. "It occurs sometimes, but not regularly."
   D. Delete the underlined portion of the text.

3. The office party was a success. The director had wanted to reward his staff with some great entertainment and some excellent food. Almost everybody had shown up and most of them had danced to the tunes of the live band. Long after the band had left, he had to remind people that the building was closing because the security and maintenance people needed to go home as well. Therefore, he took the microphone and started to sing a lullaby to remind people that the building was closing.

   A. NO CHANGE
   B. To remind people that the band had left.
   C. To remind people that the office party had been a success.
   D. Delete the underlined portion of the text.

4. During her dad's absence, Alexandra had to put in a lot of extra hours at her small store. She had to open the backdoor by six o'clock each morning, so the delivery van could unload its goods. She had to restock the shelves and haul the large boxes from the storage room to the front by herself because her dad was not there. She was used to closing the store and keeping the books, but the extra physical labor in the morning caused her to collapse into bed each night before eight o'clock.

   A. NO CHANGE
   B. because she had to restock the shelves
   C. although she was only a small woman
   D. Delete the underlined portion of the text

1) D It already said that she waited in vain, which means without success. 2) D Occasionally means that it does not happen frequently. 3) D The paragraph already stated elsewhere that the building was closing. 4) D The paragraphs starts with the words: During her dad's absence. This means her dad is not there.

Math

ESSENTIAL SKILLS
Fractions 164
Percentages 170
Averages 174
Ratios 182
NUMBER & QUANTITY
Factoring 186
Sequences 190
Exponents and Roots 194
Irrational/Imaginary Numbers 198
ALGEBRA
Simple Equations 190
Absolute Value 206
Quadratic Equations 202
Translations (Word Problems) 218
GEOMETRY
Basic Shapes 222
Angles and Triangles 228
Special Triangles 231
Pythagorean Theorem 237
Circles 240
Polygons 248
The Coordinate Plane 252
FUNCTIONS
Functions 254
Linear Equations 258
Trigonometry Review 262
The Unit Circle 269
Logic 274
STATISTICS
Probability 278
Graphs 282
Logarithms 286
THE BEAST 293
Math Test 1 296
Math Test 2 316

Ratios

Comparing Two Proportions

Example 1: One pound of sugar costs one dollar, how much do 20 pounds cost?
That one is easy. One dollar **times** twenty = $20.00

Example 2: Three pounds of salt cost 60 cents, how much do 10 pounds cost?
You could solve this by **dividing** the price by three, to get $0.20 for one pound.
Then **multiplying** $0.20 by 10 to get the answer $2.00
Alternatively, you can **cross multiply** to find the answer, because both proportions have the same relationship. $\frac{\mathbf{3}}{\mathbf{60}} = \frac{\mathbf{10}}{\boldsymbol{x}}$ = 200 cents = $2.00

*Tip: Ratio problems can be solved by **cross multiplying** the proportions.*

How to Write a Ratio

Ratios can be written as fractions, as a comparison with a colon, or by using the word "to."

The ratio of hands to fingers is	2:10	two to ten	or	$\frac{2}{10}$
This ratio can be simplified (like a fraction)	1:5	one to five	or	$\frac{1}{5}$

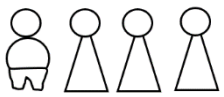
Compare the Totals

In difficult ratio questions, they never tell you the TOTAL.

The proportions in the ratio from 2:3 are *two out of five* and *three out of five.* (2/5 and 3/5)

Example 3: The proportions of the angles in a triangle are 2:3:4. Add the terms to get a total of 9.
Compare this to the total degree of angles in the triangle. All angles add up to a total of 180.

Example 4: In a 1:3 boy to girl ratio, there are FOUR parts. The boys consist of 25% (of the TOTAL): one out of four, and the girls make up 75% (of the TOTAL): three out of four.



Tip: Don't confuse 1:3 with 1 out of every 3 people. (That would be 33%.)

Tip: Remember that 2:1 is NOT the same as 1:2! The ACT likes to trick you with this!

$\sqrt{3}$:1 can also be written as 1:$\frac{\sqrt{3}}{3}$

Ratio Trap

Example: A trophy is 12" tall, and the base on which is stands is 9" tall.
Which one is the correct ratio of the height of the trophy to the height of the base?

A. 16 : 12
B. 9 : 12

Do not pick B! Notice how the statue is taller than its base. The correct proportion is 12:9, which is NOT one of the given answers. Multiply both part by $\frac{4}{3}$ to see that 16:12 is identical to 12:9. **(Answer A)**

Tip: Use common sense with ratio questions. Draw a picture to get a sense of the proportions and the TOTAL.

Ratio - Quiz 1

1. An 8-foot spruce tree has a shadow of 10 feet long in the afternoon. A six-foot man nearby has a shadow that is how long?
   A. 5
   B. 7.5
   C. 12.5
   D. 18
   E. 33

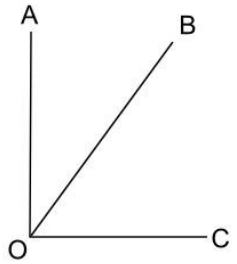
2. In a certain rectangle, the ratio of width to length is 2:3. If the perimeter of the rectangle is 30", what is the area?
   A. 6"
   B. 24"
   C. 45"
   D. 48"
   E. 54"

3. To build 5 patios, a crew needed exactly 12 bags of cement. How many bags do they need to buy to build 8 patios?
   A. 15
   B. 19
   C. 20
   D. 40
   E. 84

4. Mom has twice as many books as Dad. They have 30 books together. How many does Dad have?
   A. 10
   B. 12
   C. 15
   D. 20
   E. 45

5. In a bag of candy, the ratio of red sweets to green sweets is 3:4. If the bag contains 140 green sweets, how many red sweets are there?
   A. 40
   B. 80
   C. 90
   D. 105
   E. 187

6. ∠ AOC is a right angle and the ratio ∠ AOB : ∠ BOC = 2 : 3
   What is the size of ∠ BOC?
   A. 27
   B. 30
   C. 36
   D. 54
   E. 72



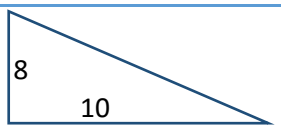
7. A police car is travelling down the highway at a high speed for a call. The distance it covers in 1 second is 132 ft. Given that there are 5280 feet in a mile, what is the police car's speed, in miles per hour?
   A. 30
   B. 45
   C. 60
   D. 75
   E. 90

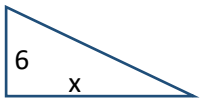
8. One match releases approximately 1,100 joules of heat energy when it is lit. If 1 kilojoule equals 239 calories, how many matches must be lit to produce at least 5,600 calories of heat energy?
   A. 5
   B. 21
   C. 21.3
   D. 22
   E. 23

1)B 2)E 3)C 4)A 5)D 6)D 7)E 8)D

Ratio - Quiz 1 (Answers)

1. When you work with proportions, draw figures! There are two triangles:

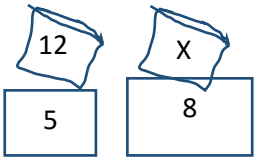




The relationship between 8 and 10 is the same as the relationship between 6 and x.
Mathematically, you can say that $\frac{8}{10} = \frac{6}{x}$
Cross-multiply: 8x = 60 ➔ x = $\frac{60}{8}$ = 7.5
(Answer B)

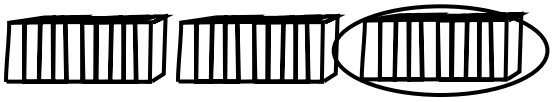
2. For every 2 units in the width, there are 3 units in the length.
a. This makes the perimeter 2 units + 3 units + 2 units + 3 units long. (= 10 units)
b. If 10 units make 30 inches, each unit must be 3 inches ($10 * 3 = 30$)
c. Therefore, the width is $3 * 2 = 6$" and the length is $3 * 3 = 9$"
d. The area of the rectangle is $6 * 9 = 54$"
(Answer E)

3. The 12 and the 5 have the same relationship as the X and the 8.



$\frac{12}{5} = \frac{x}{8}$
Cross-multiply: $5x = 96$ ➔ $x = 19.2$
But the answer is not B! 19 bags would not be enough to build 8 patios! Beware of these tricky round-off answers. They need more cement, but they cannot buy 1/5 of a bag. ➔ They need to buy 20 bags. **(Answer C)**

4. Method 1: Draw pictures. Then divide the books into two groups in which one of the groups has twice as many books as the other group:
Answer: The bigger group has 20 books, the smaller one has 10 books. Dad has 10 books!
(Answer A)



Method 2: The proportion of books is 1:2 (Total 3)
Cross-multiply: $\frac{1}{3} = \frac{x}{30}$ ➔ x = 10 **(Answer A)**

5. How many are there **total** in the ratio?
Answer:7

What part is green? Four out of seven = 4/7
What part is red? Three out of seven = 3/7

Method 1: Cross-mutiply:
$\frac{140}{4} = \frac{x}{3}$ ➔ $4x = 420$ ➔ $x = 105$ **(Answer D)**
Method 2: Cross-mutiply:
$\frac{3}{4} = \frac{x}{140}$ ➔ $4x = 420$ ➔ $x = 105$ **(Answer D)**

6. AOC is a right angle. Therefore, the two smaller angles will have a total of 90 degrees together.
We need to consider the **total** of the two ratios: the 2 and the 3 in the proportion make a total of 5, and the two angles make a total of 90.
The ratio from 5 to 90 is identical to the ratio from 2 to x. $\frac{5}{90} = \frac{3}{x}$ ➔ $5x = 270$ ➔ $x = 54$
(Answer D)

7. When you solve ratios, always change one measurement at a time. (Go from seconds to hours, then go from feet to miles.)
Always simplify to single units: 1 mile, 1 minute, 1 hour, etc.).
$\frac{1\ sec}{132\ ft} = \frac{1\ min}{60*132\ ft} = \frac{1\ hour}{60.60*132\ ft} = \frac{1\ hour}{475200\ ft} = \frac{1\ hour}{\frac{475200}{5280}\ miles} = \frac{1\ hr}{90\ miles}$ **(Answer E)**

8. Cross multiply
For 1 match: $\frac{1000}{239} = \frac{1100}{x}$ x = 262.9 calories

For the total $\frac{1}{262.9} = \frac{x}{5600}$ x=21.3 matches

You cannot light .3 of a match, so you need to light 22 matches. (21 would not be enough) **(Answer D)**

Read the question. It states, "how many matches must be lit to produce **at least** 5,600 calories."

Absolute Value

Here are some basic variations of problems with absolute value:

$|4| = x$ This means $x = 4$ The absolute value of 4 is always 4.

$|-4| = x$ This means $x = 4$ The absolute value of -4 is always 4.

$|x| = -4$ This does not exist. An absolute value is never negative.

$-|x| = 4$ Don't be fooled. $|x|$ is always positive. $-|x|$ is therefore always negative. There are therefore NO solutions for x to satisfy this equation.

$|4| = -x$ This is possible for $x = -4$. x can be negative, $|x|$cannot be negative.

$|-4| = -x$ This is possible for $x = -4$. x can be negative, $|x|$cannot be negative.

$|x| = 4$ Make two equations $x = 4$ **or** $x = -4$

$|-x| = 4$ Make two equations $-x = 4$ **or** $-x = -4$

Tip: Most ACT absolute value questions are variations of the examples above. You have to know your math and you have to do some thinking about what absolute value actually means!

Here are some more complicated variations:

$|x - 4| = Z$ **Simply means** $\boldsymbol{x - 4 = Z}$ **or** $\boldsymbol{x - 4 = -Z}$
The equation inside the absolute values can be positive or negative.
Always **make two equations** when you see an absolute value equation.

$|x - 4| = -4$ This looks like $x = 0$, but don't forget: Absolute values are always positive! There is no possible value of x that would solve this equation.

$|x - 4| = x$ A number minus 4 equals that same number? That looks impossible. But the absolute value indicates that the number can also be negative!

Make two equations: $x - 4 = x$ (impossible) **or** $x - 4 = -x$ ➔ $2x = 4$ ➔ $x = 2$

$|x - 4| = -x$ Make two equations: $x - 4 = -x$ **or** $x - 4 = -(-x)$ (impossible) ➔ $x = 2$
However, you need plug this solution into the equation: $|-2| = -2$ (impossible)

Tip: What if the absolute value is part of an equation? Treat it like a variable and move all other parts of the equation to the other side of the equal sign.

$6 - |x - 4| = 4$ Change to $-|x - 4| = -2$ => $|x - 4| = 2$
Make two equations: $x - 4 = 2$ **or** $x - 4 = -2$ ➔ $x = 2$ *or* $x = 6$

Inequalities

Tip: Make sure to flip the sign for the negative value of the absolute value!

$|x - 4| > 10$ Make two equations: $x - 4 > 10$ **or** $x - 4 < -10$ ➔ $x > 14$ or $x < -6$

$|4 - x| \leq 2$ Make two equations: $4 - x \leq 2$ **or** $4 - x \geq -2$ ➔ $x \geq 2$ and $x \leq 6$

Absolute Value - Quiz 1

1. Find a possible solution for x.
   $|x + 2| = 4$
   A. $x = -6$
   B. $x = -2$
   C. $x = 2$
   D. $x = 2 \text{ or } x = -6$
   E. There are no possible solutions for x.

2. Find a possible solution for x.
   $-|x + 4| = 2$
   A. $x = 1$
   B. $x = -7$
   C. $x = -1$
   D. $x = 7$
   E. There are no possible solutions for x.

3. Find a possible solution for x.
   $-|3| + |2 - 6| = X$
   A. $x = 1$
   B. $x = -7$
   C. $x = -1$
   D. $x = 7$
   E. There are no possible solutions for x.

4. Find a possible solution for x.
   $|-6| - |-8| * - |-x| = -34$
   A. $x = 48$
   B. $x = -5$
   C. $x = 17$
   D. $x = -17$
   E. There are no possible solutions for x.

5. Find the smallest possible value for x.
   $-|3| * |6 - x| = -12$
   A. $x = -10$
   B. $x = -2$
   C. $x = 2$
   D. $x = 10$
   E. $x = 2 \text{ or } 10$

6. Find a possible solution for x.
   $\frac{|-16|}{8} + \frac{|-x|}{6} - |-3 * 4| = -4$
   A. $x = -36$
   B. $x = -14$
   C. $x = -6$
   D. $x = 6$
   E. $x = 14$

7. Find a possible solution for a.
   $|2a + 1| + 5 = |-2 + 6|$
   A. −5
   B. −1
   C. −1 and −5
   D. 1 and 5
   E. There are no possible solutions for a.

8. Find a possible solution for a.
   $|2a + 5| = a + 4$
   A. −3
   B. −1
   C. −3 and −1
   D. ½
   E. 4.5

9. Challenge:
   Find a possible solution for x.
   $|x - 2| = 2x - 3$
   A. 1
   B. $\frac{3}{5}$
   C. $\frac{5}{3}$
   D. $\frac{3}{5}$ and $\frac{5}{3}$
   E. 1 and $\frac{5}{3}$

1)D 2)E 3)A 4)E 5)C 6)A 7)E 8)C 9)C

Absolute Values - Quiz 1 (Answers)

1. $|x+2|=4$ The equation inside the absolute values can be positive or negative. Solve for both options.

   $x+2=4$ or $x+2=-4$

   $x=2$ or $x=-6$ **(Answer D)**

2. $-|x+4|=2$ To solve absolute values, treat it like a variable and move all other parts of the equation to the other side of the equal sign. In this case, multiply both sides by -1 so that only the absolute value is on the left side of the equation.

   $|x+4|=-2$ An absolute value can never be negative. **(Answer E)**

3. $-|3|+|2-6|=X$ If absolute values only contain numbers solve them first. (Similar to using PEMDAS and first solving parentheses)

   $-3+|-4|=x$ ➔ $-3+4=x$ ➔ $x=1$ **(Answer A)**

4. $|-6|-|-8|*-|-x|=-34$ If absolute values only contain numbers solve them first.

   $6-8*-|-x|=-34$

   $-8*-|-x|=-40$ ➔ $-|-x|=5$ ➔ $|-x|=-5$

   An absolute value can never be negative. **(Answer E)**

5. $-|3|*|6-x|=-12$ If absolute values only contain numbers solve them first.

   $-3*|6-x|=-12$ ➔ $|6-x|=4$

   The equation inside the absolute values can be positive or negative. Solve for both options.

   $6-x=4$ or $6-x=-4$ ➔

   $x=2$ or $x=10$

   The question asks for the smallest possible value: $x=2$ **(Answer C)**

6. $\frac{|-16|}{8}+\frac{|-x|}{6}-|-3*4|=-4$ If absolute values only contain numbers, solve them first.

   $2+\frac{|-x|}{6}-12=-4$ ➔ $\frac{|-x|}{6}=6$ ➔ $|-x|=36$ ➔ $x=36$ *or* $x=-36$ **(Answer A)**

7. $|2a+1|+5=|-2+6|$ If absolute values only contain numbers, solve them first.

   $|2a+1|+5=4$

   $|2a+1|=-1$ Absolute values can't be negative. **(Answer E)**

8. $|2a+5|=a+4$ The equation inside the absolute values can be positive or negative.

   $2a+5=a+4$ or $2a+5=-(a+4)$ (Watch out for the negative sign!)

   $a=-1$ or $a=-3$) **(Answer C)**

9. $|x-2|=2x-3$ The equation inside the absolute values can be positive or negative.

   $x-2=2x-3$ or $x-2=-(2x-3)$

   $-x=-1$ or $3x=5$

   $x=1$ or $x=\frac{5}{3}$

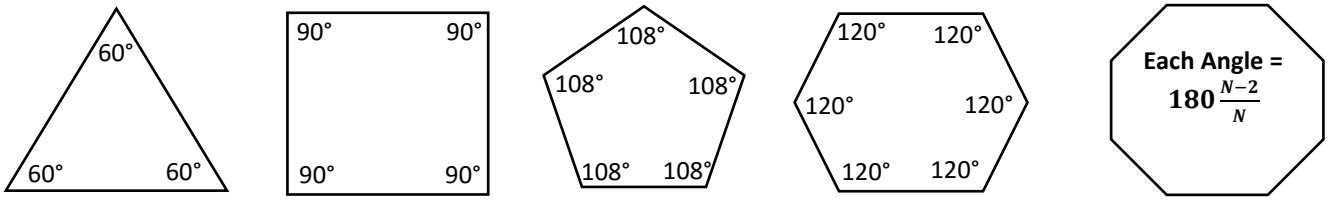
   Substituting 1 and $\frac{5}{3}$ in the question gives $|1|=-1$ (impossible) and $\left|-\frac{1}{3}\right|=\frac{1}{3}$ **(Answer C)**

Polygons

(see also page 222)

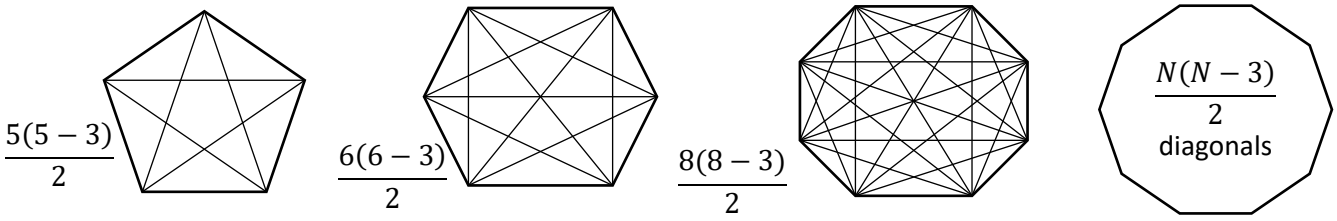
Angles in a Regular Polygon

The first polygon has THREE sides, and the angles add up to ONE times 180^0.
The next polygon has FOUR sides, and the angles add up to TWO times 180^0.
The next polygon has FIVE sides, and the angles add up to THREE times 180^0.
For a polygon with N sides, the angles add up to $(N-2)*180^0$, and each angle is $\frac{N-2}{N}\mathbf{180^0}$.

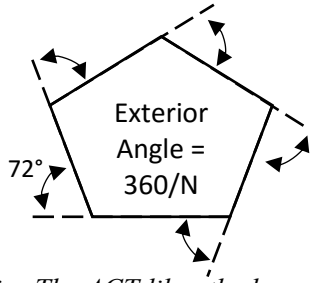


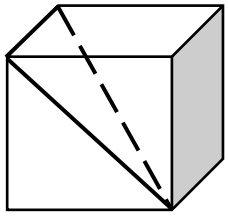
Diagonals in a Regular Polygon

The number of diagonals can be determined by counting the corners or vertices (N). Each vertex has N−3 diagonals originating from it. (There are no diagonals to its neighbors or to itself, thus N−3). However, each diagonal is counted twice this way, because it originates and ends in a vertex.



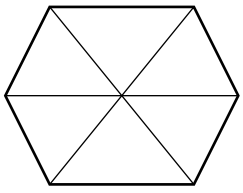
Exterior angles of a regular polygon
Each exterior angle is 360°/N





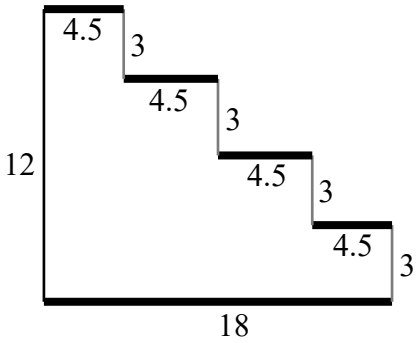
The diagonal of a cube can be determined by the Pythagorean Theorem. A quicker way is to remember that the diagonal of a cube is its **side times $\sqrt{3}$.**

Tip: The ACT likes the hexagon! Its exterior angles are 240^0, its interior angles are 120^0, and the hexagon can be split up in six equilateral triangles that have the same side as one of the sides of the hexagon.



Perimeter of a Polygon

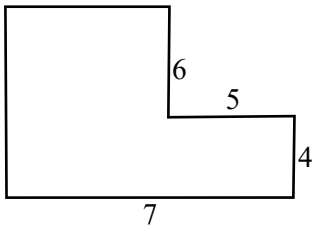
Note that all dark segments on **top** (4.5+4.5+4.5+4.5)
equal the distance of the segment on the **bottom** (18).
Note that the segments on the **right side**, (3+3+3+3)
equal the distance of the segment on the **left side** (12)



Polygon Quiz

1) What is the perimeter of a rectangle that has a side of 12 inches, and an area of 48 inches?
   A. 4”
   B. 16”
   C. 32”
   D. 36”

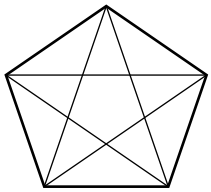
2) What is the area, in square feet, of the figure below?
   A. 32
   B. 40
   C. 46
   D. 58



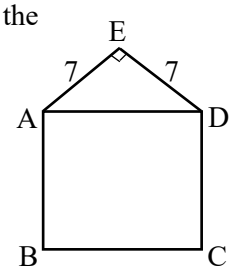
3) A trapezoid has two parallel sides, one that is 6 inches and one that is 14 inches. If the trapezoid is 7 inches tall, what is the area, in square inches, of the trapezoid?
   A. 42
   B. 98
   C. 70
   D. 140

4) Regular polygon X has 9 sides. What is the degree measure of each angle inside the polygon?
   A. 80
   B. 110
   C. 120
   D. 140

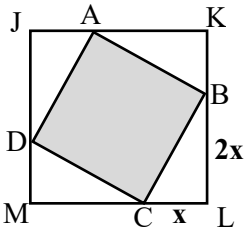
5) A pentagon has 5 diagonals. How many diagonals are there in a decagon?
   A. 9
   B. 10
   C. 28
   D. 35



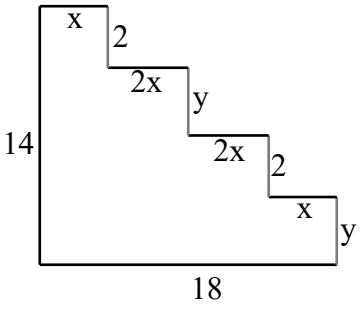
6) ABCD is a square, and ADE is an isosceles right triangle. What is the area of polygon ABCDE?
   A. 56
   B. 73.5
   C. 98
   D. 122.5



7) A shaded square ABCD is inscribed in a larger square. JKLM. $\overline{BL}$ is twice the size of $\overline{CL}$. If $\overline{JK}$ is 6 inches long, what is the area, in square inches, of the shaded region?
   A. 30
   B. 24
   C. 20
   D. 18



8) What is the perimeter of the area below?
   A. 14(6x) +18(3y+2)
   B. 32
   C. 38
   D. 64

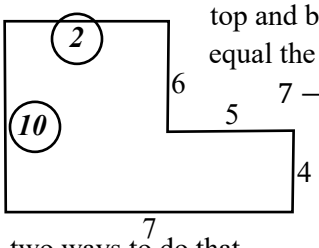


1)C 2)B 3)C 4)D 5)D 6)D 7)C 8)D

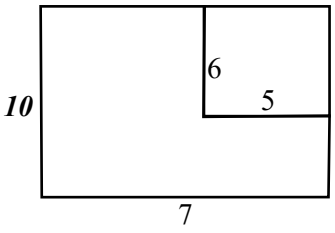
Polygon Quiz (Answers)

1) Always draw a picture! The area of the rectangle is: $B * H = 48$ ➔ $48 = 12 * X$.
$X = 48/12 = 4$ inches.
Do not mark answer A! Underline the question.
How much is the perimeter?
$4 + 12 + 4 + 12 = 32$ inches. **(Answer C)**

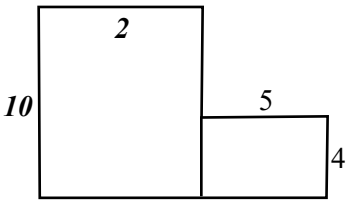
2) T.O.P. students think on paper!
Underline the questions and put all facts on the figure. Complete the rest of the measurements before answering the question. The two right sides should equal the left side 6+4=10 feet. The top and bottom sides should equal the same length.
$7 - 5 = 2$ feet.
Now we can answer the question about the area. There are two ways to do that.



Method 1) Subtract. The large rectangle is $10 * 7 = 70$ square feet. The small rectangle is $6 * 5 = 30$ square feet. The shape is therefore $70 - 40 = 40$ square feet.



Method 2) Add
The large rectangle is $10 * 2 = 20$ square feet. The small rectangle is $4 * 5 = 20$ square feet.



The shape is therefore $20 + 20 = 40$ square feet.
(Answer B)

3) Use the formula for the area of a trapezoid:
$(B_1 + B_2)/2 * H$ ➔ $\frac{6+14}{2} * 7 = 70$ square inches.
(Answer C)

4) Use the formula of angles in a polygon.
$\frac{N-2}{N}180^0$. ➔ $\frac{9-2}{9}180^0 = 140$
Alternatively, use the outside angle information. Outside angle is $360/9 = 40$ degrees. Inside angle is supplementary:
180−40=140 degrees **(Answer D)**

5) Use the formula for diagonals in a polygon:
$\frac{N(N-3)}{2}$ ➔ $\frac{10(10-3)}{2} = 35$ diagonals. **(Answer D)**

6) The triangle on top is isosceles. Therefore, it has two angles of 45 degrees. The dimensions in a 45-45-90 triangle have a ratio of 1:1:$\sqrt{2}$.
The hypotenuse of the triangle is therefore $7\sqrt{2}$.
This hypotenuse is also the side of the square. The area of the square is $7\sqrt{2} * 7\sqrt{2} = 98$.
The area of the right triangle is ½∗side∗side = 24.5.
(You can rotate the triangle and use $½ * b * h = 24.5$)
Add the shapes together to get
$98 + 24.5 = 122.5$ **(Answer D)**

7) $CL = BK, so\ we\ can$ deduce $that\ x + 2x = 6$
Therefore $x = 2\ and\ 2x = 4$
Use the Pythagorean Theorem to determine the hypotenuse of the triangle CLB $2^2 + 4^2 = h^2$
➔ $h = \sqrt{20}$. A square with sides $\sqrt{20}$ has an area of 20. **(Answer C)**

8) The four sides on the right equal the left side. (=14
The four sides on top equal the bottom side. (=18)
The perimeter is 14+18+14+18 = 64 **(Answer D)**

Logarithms

When dealing with logarithm questions, it is important to **count the exponents.**

$5*5*5*5 = 5^4 = 625$
Therefore: $\log_5(625) = 4$
5 is called the **base**. This is the number that is multiplied 4 times.
4 is called the **exponent**. This is the part that a logarithm counts.
The **log** indicates those exponents by only mentioning the base and the product: $\log_5(625)$, translates as "This is the exponent of 5 to get 625."

Example: $\log_4(16) = \log_4(4^2) = 2$
Example: $\log_{10}(1{,}000) = \log_{10}(10^3) = 3$
Example: $\log_3(81) = \log_3(3^4) = 4$

A logarithm is an expression that counts the **exponents** of a number.
It is important to review your rules about exponents. (See box on right)
Most logarithm problems in the ACT are variants of these exponent rules:

Remember:

$$\log_a(a^x) = x$$

In logarithms, you count the exponents of base *a*.
The exponent of a is x.

Therefore, the answer is x

$(\log_2(8) = \log_2(2^3) = 3)$

A^0	$= 1$
A^1	$= A$
$\sqrt{\frac{a}{b}}$	$= \frac{\sqrt{a}}{\sqrt{b}}$
$\sqrt{ab}$	$= \sqrt{a}\sqrt{b}$
$A^m A^n$	$= A^{m+n}$
$(A^m)^n$	$= A^{mn}$
$\frac{A^m}{A^n}$	$= A^{m-n}$
A^{-m}	$= \frac{1}{A^m}$
$A^{\frac{m}{n}}$	$= \sqrt[n]{A^m}$

Multiplication

$\log_a(xy) = \log_a x + \log_a y$
The log of a multiplication is the sum of the logs of each factor.
Example: $\log_2(32) = \log_2(4) + \log_2(8)$
Example: $\log_3(9x) = \log_3(9) + \log_3(x)$

Division

$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$

The log of a division is the difference of the logs of each factor.

Example: $\log_2\left(\frac{32}{8}\right) =$
$\log_2(32) - \log_2(8) = 5 - 3 = 2$
Example: $\log_2\left(\frac{1}{16}\right) =$
$\log_2(1) - \log_2(16) = 0 - 4 = -4$

*S*hortcut 1

$\log_a(a^x) = x * \log_a(a) = x$
Example: $\log_3(3^4) = 4 * \log_3(3) = 4$
Example: $\log_2(4^3) = 3 * \log_2(4) = 3 * 2 = 6$

Shortcut 2

if $\log_x(a) = y$
then $x^y = a$

Logarithms - Quiz 2 (Challenge)

1) If $\log_b d = r$ and $\log_b z = t$, then $\log_b (dz)^2 = ?$
   A. $r + t$
   B. $2rt$
   C. $4rt$
   D. $(r + t)^2$
   E. $2(r + t)$

2) Which of the following is a value of x that satisfies $\log_x 64 = 3$?
   A. 2
   B. 4
   C. 8
   D. 16
   E. 32

3) The value of $\log_{13}(13^{\frac{27}{12}})$ is between which of the following pairs of consecutive integers?
   A. 0 and 1
   B. 1 and 2
   C. 2 and 3
   D. 4 and 5
   E. 6 and 7

4) Whenever q is an integer greater than 1, $\log_q \frac{q^3}{q^9} = ?$
   A. -6
   B. -3
   C. $-\frac{1}{3}$
   D. $\frac{1}{3}$
   E. 9

5) For all $x > 3$, $\log(2x - 6) + \log x = ?$
   A. $\log(-6)$
   B. $\log(3x - 6)$
   C. $\log(2x^2 - 6x)$
   D. $\log(\frac{2x-6}{x})$
   E. $\log(\frac{x}{2x-6})$

6) $\log_2 24 - \log_2 3 =$
   A. 1
   B. 2
   C. 3
   D. $\log_2 21$
   E. 27

7) For all $x > 0$, which of the following expressions is equal to $\log(3x)^{\frac{1}{3}}$?
   A. $\log x$
   B. $\log 3 + \frac{1}{3}\log x$
   C. $\log 1 + \log \frac{x}{3}$
   D. $\frac{1}{3}\log 3 + \frac{1}{3}\log x$
   E. $\frac{1}{3}(\log 3)(\log x)$

8) Which of the following is a value of x that satisfies $\log_4(2) + \log_4(x) = -3$
   A. $\frac{1}{6}$
   B. 6
   C. $\frac{1}{64}$
   D. -6
   E. $\frac{1}{128}$

9) Express $15\log_9 r + 3\log_9 p - 6\log_9 z$ as a single logarithm.
   A. $12\log_9 rpz$
   B. $\frac{45\log_9 rp}{6\log_9 z}$
   C. $\log_9(\frac{r^{15}p^3}{z^6})$
   D. $\log_9(r^{15} + p^3 - z^6)$
   E. $\log_9((\frac{rp}{z})^{\frac{18}{6}})$

1)E 2)B 3)C 4)A 5)C 6)C 7)D 8)E 9)C

Logarithms - Quiz 2 (Answers)

1) Since both d and z are squared, when they are broken up into two log functions, each of the log functions will be multiplied by two.
$\log_b(dz)^2 = 2 * \log_b(dz)$
$2 * \log_b(dz) = 2 * \log_b(d) + 2 * \log_b(z)$
This simplifies to 2(r) + 2(t), or $2(r + t)$, **(E)**

2) This log function can be rewritten as $x^3=64$, or x = 4. **(Answer B)**

3) We can start by pulling the $\frac{27}{12}$ to the front of the equation since it is a power inside of a log, leaving us with $\log_{13} 13$, which equals 1. The value is therefore $\frac{27}{12}$, which falls between the integers 2 ($\frac{24}{12}$) and 3 ($\frac{36}{12}$). **(Answer C)**

4) Rewrite $\log_q(\frac{q^3}{q^9})$ as
$\log_q(q^3) - \log_q(q^9)$.
$\log_q(q^3) = 3$ and $\log_q(q^9) = 6$
$3 - 9 = -3$ **(Answer A)**

5) $\mathbf{\log_a(xy) = \log_a x + \log_a y}$
Since we are adding two logs with the same base, we can multiply the values and make one log function. We get $\log(x(2x - 6))$ or $\log(2x^2 - 6x)$. **(Answer B)**

6) Logarithms follow the rules of exponents. Remember $\frac{A^5}{A^3}$=A^{5-3} In much the same way, if two log equations are **subtracted** from one another and the bases are the same, it is equivalent to one log equation where the two values are **divided**.
$\log_2 24 - \log_2 3 = \log_2 \frac{24}{3.} = \log_2 8 = 3$
(Answer C)

7) $\mathbf{\log_a(a^x) = x * \log_a(a) = x}$
$\log((3x)^{\frac{1}{3}}) = \frac{1}{3}\log(3x)$
Rewrite $log(3x)$ as $log(3) + log(x)$
We can now separate the equation into two logarithms, where each is multiplied by $\frac{1}{3}$, We are left with

$\frac{1}{3}\log(3x) = \frac{1}{3}\log 3 + \frac{1}{3}\log x$. **(Answer D)**

8) Negative logarithms ask the question, "How many times do I need to **divide** a number to get the answer?" (Remember $A^{-m} = \frac{1}{A^m}$.)
Therefore 4^{-5} means $1 \div 4 \div 4 \div 4 \div 4 \div 4$
a) Combine the logs with the same base:
$\log_4(2x) = -3$
b) $4^{-3} = 2X$ ➔ $\frac{1}{4^3} = 2X$ ➔ $X = \frac{1}{2*4^3}$
c) $X = \frac{1}{128}$ **(Answer E)**

9) Since all of the bases are the same, we know we can combine them together. The first step is to change all of the multiplications into powers within the function, so we get
$\log_9 r^{15} + \log_9 p^3 - \log_9 z^6$.
Now we combine them into one function, where those added together are multiplied and those subtracted are divided. This leaves us with an answer of $\log_9(\frac{r^{15}p^3}{z^6})$, **(Answer C)**

THE BEAST: All high school math formulas that matter on the ACT.

Exponents

$A^0 = 1$ $A^1 = A$

$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

$\sqrt{ab} = \sqrt{a}\sqrt{b}$

$A^m A^n = A^{m+n}$

$(A^m)^n = A^{mn}$

$\frac{A^m}{A^n} = A^{m-n}$

$A^{-m} = \frac{1}{A^m}$

$A^{\frac{m}{n}} = \sqrt[n]{A^m}$

$\log_a a^x = x$ $(\log_2 8 = \log_2 2^3 = 3)$

$\log_a(xy) = \log_a x + \log_a y$

$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$

Quadratic Formula

$Ax^2 + bx + c = 0$

$\rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Distance Time Formula

Speed (v) $= \frac{Distance\ (d)}{Time\ (t)}$ $t = \frac{d}{v}$

Linear Equations

$y = mx + b$

y intercept is b (x=0)

The slope is $m = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$

A perpendicular line has a slope of m: $-\frac{1}{m}$

Distance Formula $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint Formula $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Prime numbers

First six primes: 2,3,5,7,11,13

Perfect squares

Commonly used on the ACT:
11^2=**121**; 12^2=**144**; 13^2=**169**;
14^2=**196**; 15^2=**225**; 16^2=**256**;

Irrational numbers

Cannot be written as a ratio of two integers: (e.g. π, √2, √3)

Percent

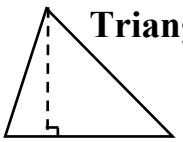
$\frac{\%}{100} = \frac{is}{of} = \frac{part}{whole}$

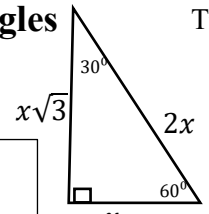
Probability

$\frac{desired\ outcomes}{possible\ outcomes}$

$(a+b)^2 = a^2 + 2ab + b^2$
$(a-b)^2 = a^2 - 2ab + b^2$
$(a+b)(a-b) = a^2 - b^2$

Triangles



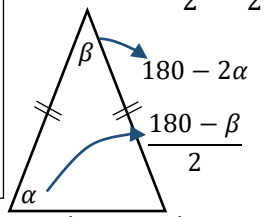


Triangle Area = $\frac{1}{2} * b * h$

Equilateral triangle Area: $\frac{1}{2}S * \frac{1}{2}S\sqrt{3}$

Pythagorean Theorem: $a^2 + b^2 = c^2$

3, 4, 5
5, 12, 13
6, 8, 10
7, 24, 25
8, 15, 17



Isosceles triangle

Imaginary Numbers

When squared, gives a negative result

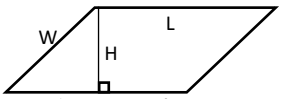
$i * i = -1$ $i = \sqrt{-1}$ $\sqrt{(-x)} = i\sqrt{x}$

$i^1 = i; i^2 = -1;\ i^3 = -i\ ;\ i^4 = 1; i^5 = i^1$

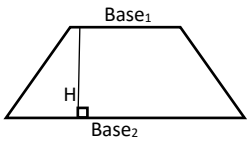
Mean: Average ‖ **Median**: Middle number (if sorted!)

Mode: Most frequent number

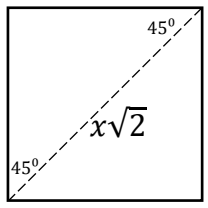
Weighted average: Add the values for each occurrence; divide by total occurrences.



Area = L*H



Area = $\frac{(B_1 + B_2)}{2} * H$



Circles

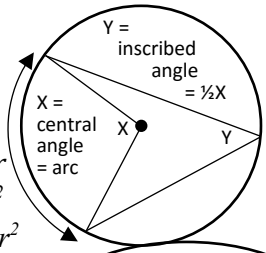
Area = πr^2

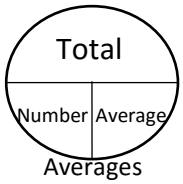
Circumference = $2\pi r$

Formula: $x^2 + y^2 = r^2$

For $(x-a)^2 + (y-b)^2 = r^2$

→Midpoint = (a,b)
Radius = r





Averages

Sum of angles in a regular polygon with n sides: **180(n-2)**

# of diagonals = $\frac{1}{2} * n(n-3)$

TRIG:: SOH-CAH-TOA

$\sin\theta = \frac{Opp}{Hyp}$ $\csc\theta = \frac{1}{Sin}$

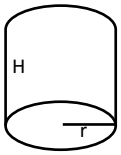
$\cos\theta = \frac{Adj}{Hyp}$ $\sec\theta = \frac{1}{Cos}$

$\tan\theta = \frac{Opp}{Adj}$ $\cot\theta = \frac{1}{Tan}$

$tan\theta = \frac{sin\theta}{cos\theta}$

Ellipse: $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

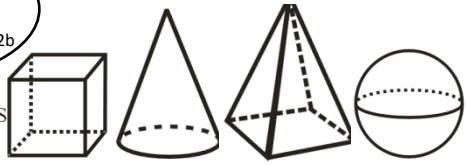
Major axis = 2a; minor axis = 2b

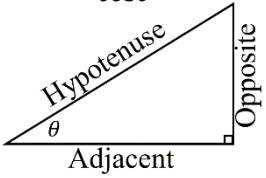


Cylinders

Area: $\pi r^2 + \pi r^2 + h*2\pi r$

Volume: $\pi r^2 * h$





≅ Congruent (shape and size)
~ Similar (shape)

Volume: Cube: V = s^3 Cone: V = 1/3 πr^2 h
Pyramid: V = 1/3 lwh Sphere: V= 4/3 π r^3

THE BEAST: All high school math formulas that matter on the ACT.

Exponents

A^0 =

A^1 =

$\sqrt{\frac{a}{b}}$ =

$\sqrt{ab}$ =

$A^m A^n$ =

$(A^m)^n$ =

$\frac{A^m}{A^n}$ =

A^{-m} =

$A^{\frac{m}{n}}$ =

$\log_a a^x$ =

$\log_a(xy)$ =

$\log_a\left(\frac{x}{y}\right)$ =

Quadratic Formula

$Ax^2 + bx + c = 0$

➔ x =

Distance Time Formula

Speed (v) =

Linear Equations

$y = mx + b$

y intercept is

X intercept is

The slope is

A perpendicular line has a slope of

Distance Formula d =

Midpoint Formula

Prime numbers
First six primes:
Perfect squares
Commonly used on the ACT:
11^2= ; 12^2= ; 13^2= ;
14^2= ; 15^2= ; 16^2= ;
Irrational numbers
Definition:
Example:

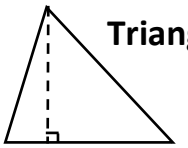
Imaginary Numbers
When squared, gives a negative result
$i * i$ = i = $\sqrt{(-x)}$ =
i^1 = ; i^2 = ; i^3 = ; i^4 = ; i^5 =
Mean: ‖ **Median**:
Mode:
Weighted average:

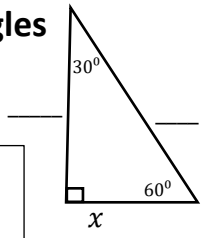
Percent
$\frac{\%}{100}$ = ____ = ____

Probability
_____

$(a+b)^2$ =
$(a-b)^2$ =
$(a+b)(a-b)$ =

Triangles

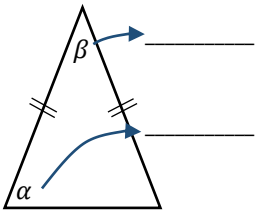




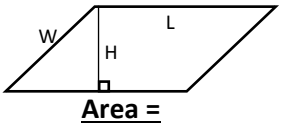
Triangle
Area =

Equilateral Triangle
Area =

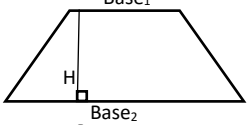
Pythagorean Theorem:
_ ² + _ ² =
3, — —
5, — —
6, — —
7, — —
8, — —



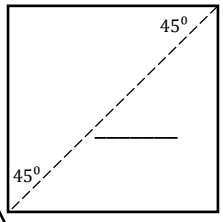
Isosceles triangle



Area =



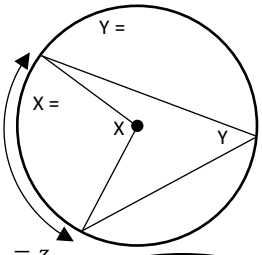
Area =

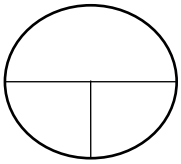


Circles

Area =
Circumference =

Formula:
For $(x-a)^2 + (y-b)^2 = z$
➔Midpoint =
Radius =



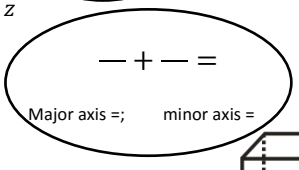


Averages

Sum of angles in a regular polygon with n sides:

# of diagonals =

Ellipse:



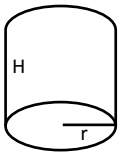
TRIGONOMETRY:

Use A, B and C

Sin θ = — Csc θ = —

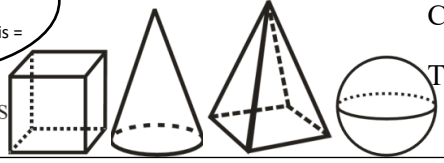
Cos θ = — Sec θ = —

Tan θ = — Cot θ = —

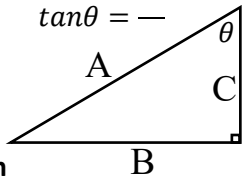


Cylinders

Area:
Volume:



$tan\theta$ = —



≅
~

Volume: Cube: Cone:
Pyramid: Sphere:

For interactive formulas visit **www.analyzeyouract.com**

Math Test 1

60 minutes, 60 questions

Answer key Page 306
Trendsheet Page 307
Explanations Page 308

Reading

READING 333

The Three Parts of the Reading Test ... 334

Reading Part I - The Text 335
One-Minute Speed Reading Test 336
Top 10 Reading Strategies 337
Reading Precisely 338

Reading Part II - The Questions 345
Clarity 347
Inference Questions 349
Word Choice - Vocab in Context 354
Tone of Voice 357
How to Find the Main Idea 359

Reading Part III - The Answers 361
The Fake 362
The Switch 364
The Extreme 366
The General 368
Reading Tips - What To Do 370
Reading Test 1 373
Reading Test 2 389

Word Choice - Vocab in Context

Words can have different meanings depending on the sentence in which they appear.
Consider the word "set". They were working on the *set* for the play. (backdrop) The tennis player won the first *set*. (part of a match). She had a *set* of matching antique vases. (collection). As you can quickly see, it is impossible to tell the meaning without the context.

Tip: When you face a question about the meaning of a word, do not look at the word. In fact, cross it out! xxxxx Look at the rest of the sentence and find out what kind of word is missing. Draw your own conclusion before looking at the answers.

Tip: Reread the whole sentence again and substitute the four answers. Which makes most sense?

One day, a young student named Joey noticed many vacant seats in his English class. He asked the teacher, "Where are all of the other students at?" "Some of your classmates have gone to see a musical." Ms. Marshall replied with her usual xxxxx[1]. "However, it seems I need to repair[2] your grammar today, don't I, Joey?" she xxxx[3]. "Everyone please get out a sheet of notebook paper and begin to take notes for our English lesson." All of the students really enjoyed Ms. Marshall's English class, and even Joey wasn't upset because of the way she used to tailor[4] her model[5] sentences to a topic he enjoyed, such as ice cream or recess. Joey learned that he should not have used the word "at" in his question, as leaving it out would still result in the same function[6]. From now on, he intended to recycle[7] what he'd learned, so that he could become one of the best students ever.

1) As it is used in this sentence, "xxxxx" most nearly means
   - **A.** index
   - **B.** enroll
   - **C.** formality
   - **D.** sign up
2) Which of the following alternatives to the word "repair" would be least acceptable?
   - **A.** fix
   - **B.** mistake
   - **C.** mend
   - **D.** improve
3) As it is used in this sentence, "xxxx" most nearly means
   - **A.** labeled
   - **B.** touched
   - **C.** flagged
   - **D.** added
4) Which of the following alternatives to the word "tailor" would be least acceptable?
   - **A.** customize
   - **B.** adapt
   - **C.** designer
   - **D.** mold
5) As it is used in this sentence, "model" most nearly means
   - **A.** version
   - **B.** textbook
   - **C.** reproduction
   - **D.** copy
6) Which of the following alternatives to the word "function" would be least acceptable?
   - **A.** gathering
   - **B.** purpose
   - **C.** meaning
   - **D.** use
7) As it is used in this sentence, "recycle" most nearly means
   - **A.** use again
   - **B.** convert into usable materials
   - **C.** salvage
   - **D.** separate from other materials

1) C The word was "register" 2) B 3) D the word was "tagged" 4) C 5) B 6) A 7) A

Vocab in context - Quiz 1

Tip: When you see three words with the same meaning, and one word that stands out, that odd one out is often the correct answer. Look for a 3/1 split in the word choice answers. If one of the three similar ones is the correct answer, the other two should also be correct. Therefore, neither one can be the correct answer.

Today was Stacy's first day as a cadet at West Point Military Academy. While in line to register for classes she met another student, James, who seemed to know the ropes[1]. "Put your hair up in a bun," he told Stacy, "otherwise the brass[2] will give you a demerit. The army has a strict protocol, so you better learn how to address[3] your superiors before classes start." Stacy was grateful for any help she could get. She had heard rumors about what to expect: long hours to cement[4] knowledge of survival skills, obstacle courses so difficult they made the weakest cadets' knees buckle[5], and social events that were anything but a riot[6]. She was not worried about actually serving in the army, though; advances in military technology[7] meant it was unlikely that she would ever see combat.

1) As used in this sentence, the word "ropes" most nearly means
   A. strings
   B. procedures
   C. controls
   D. classes

2) As it is used in this sentence, "brass" most nearly means
   A. a shiny metal
   B. a category of musical instruments
   C. an officer
   D. brashness

3) Which of the following alternatives to the bolded portion would be least acceptable?
   A. listen to
   B. converse with
   C. speak to
   D. communicate with

4) As it is used in this sentence, "cement" most nearly means
   A. pour concrete
   B. learn something well
   C. constantly forget
   D. bind things together

5) Which of the following alternatives to the word "buckle" would be least acceptable?
   A. fold
   B. collapse
   C. crumple
   D. clasp

6) As it is used in this sentence, "riot" most nearly means
   A. a disturbance of the peace
   B. a fun time
   C. a type of military drill
   D. a protest

7) Which of the following alternatives to the word "technology" would be most acceptable?
   A. computers
   B. drones
   C. weaponry
   D. automation

1)B 2)C 3)A 4)B 5)D 6)B 7)A

The Switch

A great way for the ACT to come up with wrong answers is switching items.

SWITCHING PEOPLE

Sometimes the answer mentions two people performing an action, while only one did it.
It is easy to mix up the people in a story that you read just once, especially if the names are unusual.
Because you do not have time to reread the article, you have to anticipate this distractor.

*Tip: Make it a habit to **circle names.***

Example 1: In front of the owner of the paper, Joshua Stuart, the editor-in-chief Josiah told the freelancer that the deadline had passed.

- **A.** The editor told Josiah that the deadline had passed.
- **B.** Joshua told the editor that the deadline had passed.
- **C.** Josiah heard from the freelancer that the deadline had passed.
- **D.** The freelancer heard from Josiah that the deadline had passed.

SWITCHING THE ORDER OF EVENTS


Often, ACT answers use the exact words from the text, but not in the right order.
Tip: Watch out for words like before, earlier, already, previously, until that time, first, last, former, preceding, after, next, prior, later, etc.

Example 2: Until he discovered Lego blocks, my son's favorite toy was a red fire truck. It had eight wheels and an extension ladder. My son took it everywhere and parked it on the dining room table when he ate his meals.

What is the favorite toy of the author's son?

- **A.** A red firetruck
- **B.** Lego's

Example 3: Barack Obama is the president of the United States of America. Before that, he was an Illinois senator, and prior to that, he taught at the University of Chicago Law School.
Answer choice A: The article states that Obama first was a president, then he was a senator, and then he taught law at the University of Chicago.

See how the answer mimics the text, but misconstrues the order of the events?

SWITCHING CAUSE AND EFFECT.

Example 4: Because I ate only three Cheerios this morning, I was not very hungry.

Your brain makes a connection between the two events. After all, not being hungry and eating only three Cheerios go very well together. However, your brain does not always register HOW these two events are related. Therefore, you have to rephrase the sentence to verify: I ate only three Cheerios, and that resulted in my not being hungry? If I ate only three Cheerios, I should be hungry! Let's reverse the statement! Because I was not very hungry, I ate only three Cheerios. That makes a lot more sense.

Tip: Be aware of cause and effect answers, and verify the logic between the two parts.

Distractors - Quiz 2 (The Switch)

The battle of Chancellorsville marked the zenith of Confederate good fortune. Immediately afterward, in June, 1863, Lee led the victorious army of Northern Virginia onward into Pennsylvania. The South was now the invader, not the invaded, and its heart beat proudly with hopes of success; however, these hopes went down in bloody wreck on July 4, when word was sent to the world that the high valor of Virginia had failed at last on the field of Gettysburg, and that, just before in the far West, Vicksburg had been taken by the army of the "silent soldier."

At Gettysburg, Lee had under him some seventy thousand men, and his opponent, Meade, about ninety thousand. Both armies were composed mainly of seasoned veterans, trained to the highest point by campaign after campaign and battle after battle; and there was nothing to choose between them as to the fighting power of the rank and file. The Union Army was the larger, yet most of the time it stood on the defensive; for the difference between the generals, Lee and Meade, was greater than could be bridged by twenty thousand men. For three days, the battle raged. No other battle of recent time has been so obstinate and so bloody. The victorious Union army lost a greater percentage in killed and wounded than the allied armies of England, Germany, and the Netherlands lost at Waterloo the year before. Four of its seven corps suffered each a greater relative loss than befell the world-renowned British infantry on the day that saw the doom of the French emperor. The defeated Confederates at Gettysburg lost, relatively, as many men as the defeated French at Waterloo; but whereas the French army became a mere rabble, Lee withdrew his formidable soldiery with their courage unbroken, and their fighting power only diminished by their actual losses in the field.

FROM *HERO TALES FROM AMERICAN HISTORY,* BY HENRY CABOT LODGE AND THEODORE ROOSEVELT

1. The battle of Chancellorsville took place

- **A.** before June, 1863.
- **B.** in June, 1863.
- **C.** between June, 1863, and July 4, 1863.
- **D.** on July 4, 1863.

2. The article does not mention Lee's involvement in

- **A.** Vicksburg.
- **B.** Gettysburg.
- **C.** Chancellorsville.
- **D.** Pennsylvania.

3. The correct order of the battles is:

- **A.** Chancellorsville, Vicksburg, Waterloo, Gettysburg.
- **B.** Chancellorsville, Waterloo, Vicksburg, Gettysburg.
- **C.** Waterloo, Gettysburg, Chancellorsville, Vicksburg.
- **D.** Waterloo, Chancellorsville, Vicksburg, Gettysburg.

1) C 2) A 3) D

Reading Test 1

4 passages:
Prose Fiction
Social Science
Humanities
Natural Science

35 minutes
40 questions

Answer key Page 383

Trendsheet Page 384

Explanations Page 385

Science

Contents

TABLES **408**
Tables - Quiz 1 Football 409
Tables - Quiz 2 Solubility 411
Tables - Quiz 3 Air Conditioning. 413
Tables - Quiz 4 Soda and Candy.. 415
Tables - Quiz 5 Approval Rates... 417
Tables - Quiz 6 Bouncy Balls 419
Tables - Quiz 7 Treadmill 421
Tables - Quiz 8 Crop Rotation 423
GRAPHS – OVERVIEW 426
Graphs - Quiz 1 Elephant tusks..... 429
Graphs - Quiz 2 Immigration 1 431
Graphs - Quiz 3 Pitching speed..... 433
Graphs - Quiz 4 Weather 435
Graphs - Quiz 5 Immigration 2 437
Graphs - Quiz 6 Invasive species 438
Research Summaries (Experiments) 442
Experiments 1 – Bouncing balls 443
Experiments 2 – Tire Pressure 445
Experiments 3 – Acidity 447
CONFLICTING VIEWPOINTS 450
Viewpoints 1 – Screeching noises 451
Viewpoints 2 – Vegetarian diets 453
Viewpoints 3 – Dementia 455
Viewpoints 4 – Mpemba Effect 457
SCIENCE TEST 1 459
Science Test 1 - Answer Key 472
Science Test 1 - Explanations 474
SCIENCE TEST 2 479
Science Test 2 - Answer Key 492
Science Test 2 - Explanations 494

Graphs - Test-taking Skills

The science test will be the last part of your ACT. Most likely, you will be less alert than you were when you started! Work through the exercises in this book to practice your skills and habits that will help you to avoid simple mistakes.

Draw on your graphs to create visual clues.

Tip: If there are two lines, label the lines to avoid confusion and to save time by eliminating the key.
Tip: Information in the Y-axis is often overlooked because it is printed vertically. Make it a habit to circle the units, and mark the peaks and valleys.

- Check the scale on the graph. Each part of the line represents certain data.
- Connect the X and Y values of a data point with swift lines of your pencil, not with your eyes!

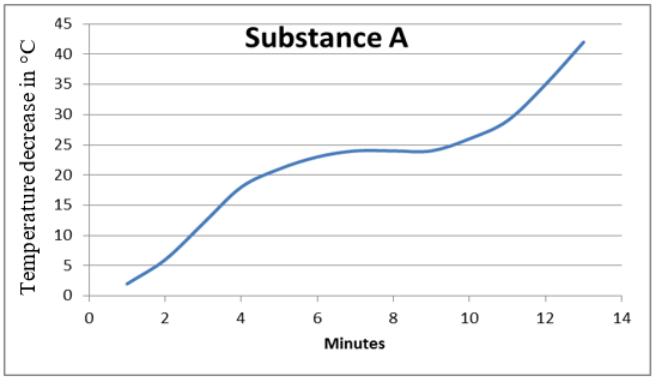
Complicated graphs are simply three or four stories in the same graph. Rather than being intimidated and continue straight to the questions, "READ" the graph, and separate the individual stories.

Tip: Take it one step at a time. Make quick notes for each bar, line, or relationship on the graph

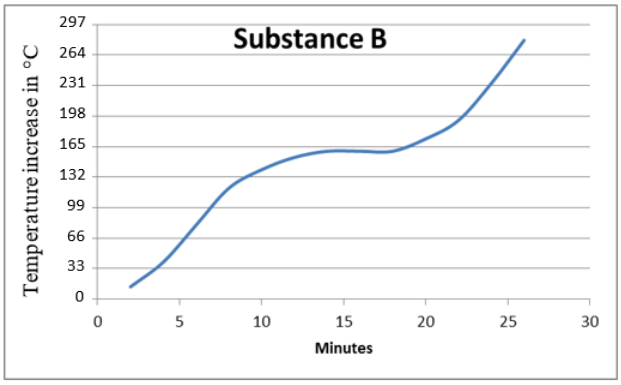
Tip: If a graph has an abbreviation, STOP! Find out in the text what the abbreviation stands for so that you can understand the story in the graph.
Tip: If two graphs look alike, identify the differences in the graph.

Read the graphs to **spot the difference**. (The Scale? The Y-axis? The title? The year?) Read the text to find out **what caused the difference**. (A different ingredient? A different method? Etc.)

1. Do substance A and B follow the same pattern when it comes to temperature and time?



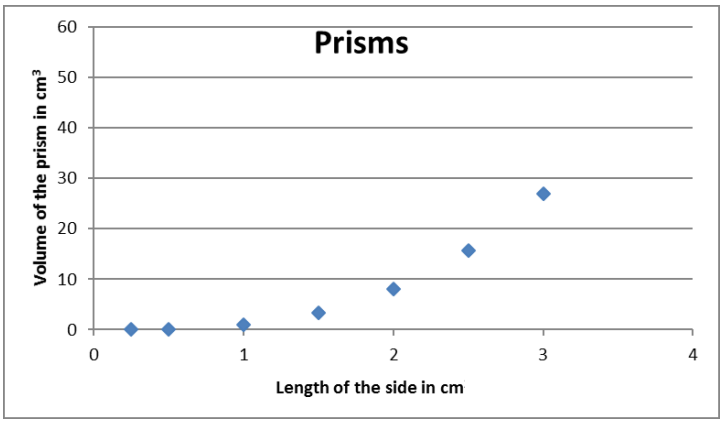
Graph 1



Graph 2

*Tip: For "what if" questions, **draw the data on the graph**! Looks can be deceiving.*

1. According to Graph 3: How much would the volume be with a side length of 4 cm? What about a side length of 5 cm?



Graph 3

1) Different Y and X axes. Did you spot the increase / decrease in the Y-axis? 2) Side length 4: 64. The line curves exponentially. Side length 5: 125 Volume = S^3

Graphs - Quiz 6: Invasive species **3 minutes**

An invasive species is a species that has been introduced to an area in which it would normally not be found. A prolific example is the European Starling, a mostly *insectivorous* bird that was introduced to North America in the mid-20th century. Below is a graph that demonstrates the effect of this invasive species on a 15-square-mile region of North America where in 2003 a few European Starlings were introduced to an otherwise stable ecosystem.

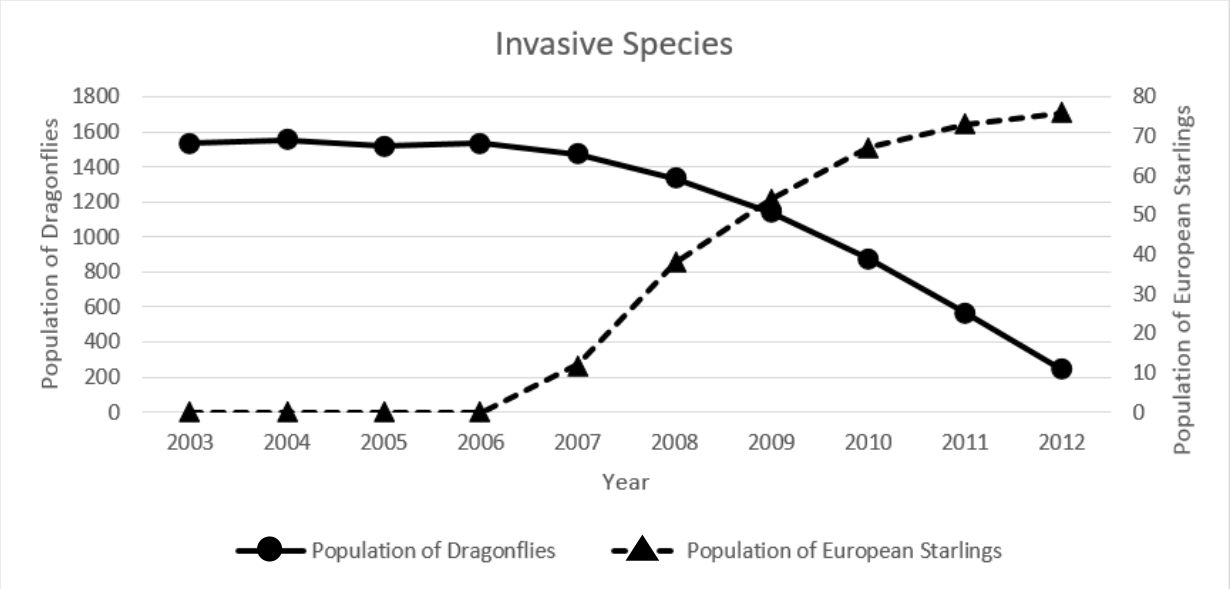


Figure 1

1. In which year are the dragonfly and European Starling populations closest to each other?
   A. 2003
   B. 2008
   C. 2009
   D. 2012

2. How many dragonflies were in the area of study in 2011?
   A. Approximately 30
   B. Approximately 70
   C. Approximately 550
   D. Approximately 1600

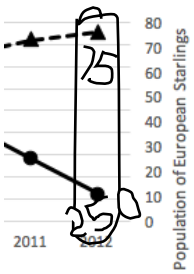
3. What is the most likely explanation of the data in Figure 1?
   A. When the starlings were introduced, they disrupted the ecosystem and caused the dragonflies to migrate to a new location.
   B. The starlings that were introduced disrupted the food chain because the birds consumed dragonflies at a greater rate than the insects could repopulate.
   C. The starlings ate all the dragonflies, which allowed the population of starlings to grow rapidly.
   D. The dragonflies were able to grow rapidly in population because the starlings competed with the insects' main predator.

1) D 2) C 3) B

Graphs - Quiz 6: Invasive species (Answers)

1. In which year are the dragonfly and European Starling populations closest to each other?

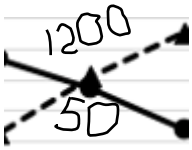
The key to this question is to look at the values on both vertical axes. In Figure 1, each horizontal line represents different populations for starlings and dragonflies. In 2009, the same horizontal line represents 50 European Starlings (on the right) and 1200 dragonflies (on the left.) Draw arrows and circle your y-axis to form a habit of reading accurate data.



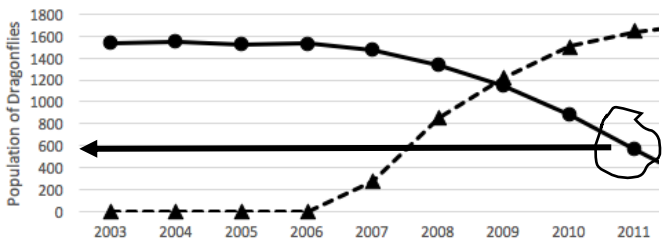
This question asks when the populations are closest to one another. Since the European Starlings never reach a population above 75 and the dragonflies never reach a population less than 250, we already know that the two populations are never equal to one another, but they come closer and closer each year.

The highest point on the graph for the European Starlings population and the lowest point on the graph for the dragonfly population happen in the same year: 2012. **(Answer D)**

Tip: When two lines cross but represent data on two different axes with two different scales, the intersection has no meaning at all. It is only a visual distraction.



2. How many <u>dragonflies</u> were in the area of study in 2011?



To find the population of dragonflies you must use the correct set of data. The solid line and the left vertical axis represent the population of dragonflies. The population of dragonflies was slightly less than 600. **(Answer C)**

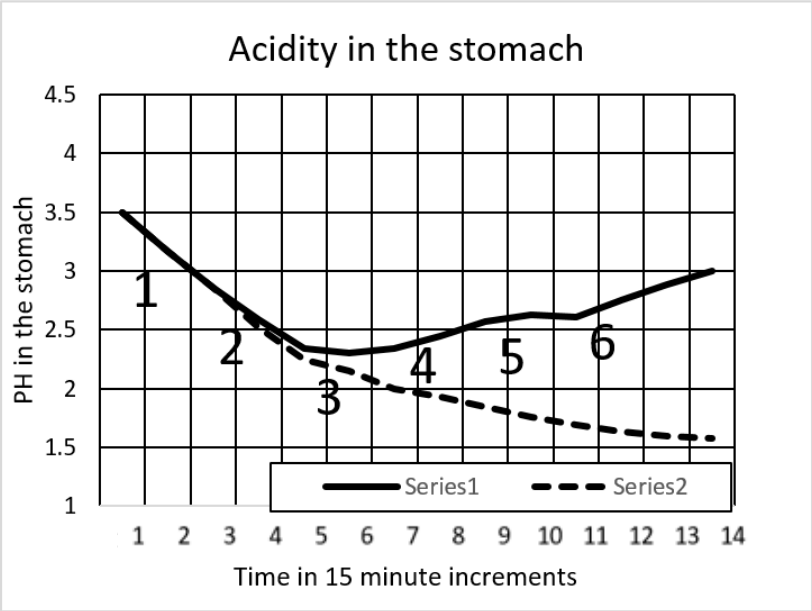
The most common mistake is to let your eyes do the job. It is easy to spot 2011 on the X-axis, and it is not difficult to determine that the solid line represents the dragonflies. However, your eyes will look for the closest data reference, which is <u>on the right</u>, but wrongly tells you how many starlings were observed in 2011.

3. What is the most likely explanation of the data in Figure 1?

Answer C states that the starlings ate <u>all</u> the dragonflies, which is incorrect.
Answer D states that the dragonfly population increased, which is not true based on the graph.

That leaves only Answer A and Answer B. Both answers are possible explanations for the decrease in the dragonflies population, but Answer A does not give a reason for the increase in the starling population.
On the other hand, choice B uses information from the text (The starlings are insectivorous, which means they eat insects) to explain why there was a decrease in the dragonflies, while in the meantime the starlings thrived. Note how the slope is flattening out due to the decreased food supply in 2011 and 2012. **(Answer B)**

Experiments-Quiz 3: Acidity **3 minutes**



When people eat food, the stomach's parietal cells produce hydrochloric acid to help break down food. In some individuals, this can cause heartburn, which feels like a burning sensation in the chest and is caused by acid regurgitation into the esophagus. *Antacids* often help to neutralize the acid and reduce the effect of heartburn.

Each 15 minutes, the patient ate 50 grams of highly fatty foods to keep the amount of food in the stomach constant during the whole test period. Scientists then tested five different remedies to reduce the acidity of the stomach lining. These antacids were administered during regular intervals. The acidity of the stomach was measured each 15 minutes in PH. (PH stands for "power of hydrogen." It is a logarithmic scale of the molar concentration of hydrogen ions.) The results of the first trial are displayed in the graph as Series 1. A day later, the experiment was repeated under the same circumstances, but without antacids. This experiment was recorded as Series 2.

1) Exactly 1.5 hours after the start of the first trial, the PH in the stomach was
   - **A.** between 1.5 and 2.
   - **B.** between 2 and 2.5.
   - **C.** between 2.5 and 3.
   - **D.** between 3 and 3.5.

2) The scientists dismissed two antacids because they did not seem to have an effect on reducing the stomach acidity. These antacids were
   - **A.** antacid number 1 and 2.
   - **B.** antacid number 2 and 3.
   - **C.** antacid number 1 and 5.
   - **D.** antacid number 3 and 5.

3) Compared to series 1, the acidity in the stomach during the control test was
   - **A.** generally higher than in series 1.
   - **B.** generally lower than in series 1
   - **C.** the same in the first three hours and then the PH was higher.
   - **D.** the same in the first three hours and then it was lower.

4) During Day 2 (series 2), how did the acidity at the end of the eighth 15-minute interval compare to the acidity at the end of the second 15-minute interval?
   - **A.** 1 times stronger
   - **B.** 1.5 times stronger
   - **C.** 2 times stronger
   - **D.** 10 times stronger

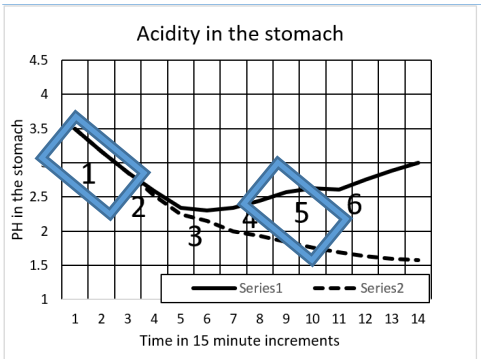
1) B 2) C 3) A 4) D

Experiments - Quiz 3: Acidity (Answers)

1) **Exactly 1.5 hours after the start of the first trial, the PH in the stomach was**

Since this question is asking for information about the first trial, the only important data points are in Series 1 (the non-dashed line). One and a half hours of data is **six** time increments (each time increment is 15 minutes). After 1.5 hours, Series 1 is between PH 2 and 2.5. **(Answer B)**

2) **The scientists dismissed two antacids because they did not seem to have an effect on reducing the stomach acidity. These antacids were**



The section next to the graph states that Series 2 was the control group (no antacids were taken) and Series 1 was the experimental group (antacids were taken). The first antacid had obviously no effect. (Both the control and the antacid produced the same results.) Antacid number 2 had a small impact on the stomach acidity by slowing the process down. Antacid number 3 was able to bring the PH up again, and so did 4 and 6. (look at the effect these last three antacids had by observing what happened in the 15 minutes afterwards. Number 1 and 5 did not have the desired result. **(Answer C)**

3) **Compared to Study 1, the acidity in the stomach during the control test was**

Watch out for graphs with inverse values. Underline the question: Does it ask about the PH, or the Acidity? Does the answer talk about the first three hours, or the first three 15-minute intervals? According to the text, Series 1 (experimental group) is the non-dashed line and Series 2 (control group) is the dashed line. This question is asking to compare the two days of study. The PH scale ranges from 0-14. Any PH lower than 7 is considered to be acidic. When acidity rises (gets higher) the PH gets lower (closer to 0). The control group always has a higher or equal acidity (lower PH) as the experimental group. Therefore, the acidity in the control test was generally higher than in Day 1 (Series 1). **(Answer A)**

4) **During Day 2 (Series 2), how did the acidity at the end of the seventh 15-minute interval compare to the acidity at the end of the second 15-minute interval?**

Use you pencil or your index finger. Check the dotted line. After seven 15-minutes intervals, the PH was 2; after two 15-minutes intervals, the PH was 3.
The PH scale is logarithmic. (Yes, there are a few scientific facts that the ACT expects you to remember from class.) Therefore, the acidity was 10 times stronger after almost 2 hours.
(Answer D

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