

PCAT Test Blueprint and Sample Items for 2012–13

Verbal Ability

Verbal Ability Content Objectives
V1. Analogies
A. Similarity/Contrast (synonyms, definitions, similarities, antonyms, contrasts, differences)
B. Association (predication, affiliation; sequence, reciprocal, by-product, transformation; cause/effect, creator/creation, function of, action taken by, purpose for, tool used by)
C. Classification (hierarchical relationship, classification, inclusion; member/class, class/member; members of same class or category)
D. Whole-Part/Part-Whole (part of, aspect of, component of, ingredient of, section of, division of, piece of)
E. Characteristic (characterization, attribute, description, lacking quality, source, component, location, setting)
V2. Sentence Completion
A. Noun(s) (each correct answer is a noun)
B. Verb(s) (each correct answer is a verb)
C. Adjective(s) (each correct answer is an adjective)
D. Combination (correct answers are more than one part of speech)

Analogy Items

- The terms in the analogy item stem may consist of a single word (e.g., “Water”), a pair of words or short phrase representing a single idea (e.g., “Water Table”; “Water on the Brain”), or the name of a historical figure (e.g., “Martin Luther King”).
- The first two terms in a stem are related in a clear, conceptual way.
- The third term must be combined with one of the answer options to form the same relationship as the first two terms in the stem.
- The correct answer must be the **only** term among the four options that completes the analogy begun in the stem.
- Each incorrect answer option may seem plausible and will relate in some conceptual way to the third term in the stem, but not in a way that correctly completes the analogy.

Sentence Completion Items

- A sentence completion item stem will be in the form of a complete sentence with either one or two words or short grammatical phrases left out.
- The correct answer will be the **only** option that is conceptually and grammatically correct in relation to the sentence in the stem.
- Each incorrect answer option may be plausible and will relate in some conceptual way to some aspect of the sentence in the stem but not in a way that correctly fills in the blank(s).

Examples of Verbal Ability Items

In the following sample Verbal Ability items, the correct answer for each item is followed by an asterisk (*), and each answer option is followed by a bracketed explanation for why it is correct (CA) or incorrect (neither of which will appear in the actual test).

Verbal Ability Example 1: Analogy

Content Objective: V1A

Acquiescent : Compliant :: Audacious :

A. Brazen *

[CA: If one is acquiescent or compliant, one accepts something passively. Audacious or brazen suggests bold, daring behavior.]

B. Timid

[Timid is used to describe one who lacks confidence or shows fear, which is an antonym to audacious and is not related in the same way as acquiescent is to compliant.]

C. Stoic

[Stoic is used to describe one who is indifferent to pleasure or pain, which is not similar in meaning to audacious, as acquiescent is to compliant.]

D. Peaceful

[Peaceful is used to describe one who is undisturbed by agitation, which is not similar in meaning to audacious, as acquiescent is to compliant.]

Verbal Ability Example 2: Analogy

Content Objective: V1B

Mammalogy : Primate :: Ichthyology :

A. Zoologist

[Although a zoologist may specialize in ichthyology (which is a branch of zoology), a primate is not related to mammalogy in a similar way.]

B. Trout *

[CA: Mammalogy involves the study of mammals, and a primate is a type of mammal. Ichthyology involves the study of fishes, and a trout is a type of fish.]

C. Lemur

[A lemur is a type of animal (a primate), but its relationship with ichthyology (a branch of zoology) is not similar to the much more specific relationship between primate and mammalogy.]

D. Vertebrate

[Though fishes that are studied by ichthyologists are vertebrates, the relationship is not specific enough to be similar to the relationship between mammalogy and lemurs.]

Verbal Ability Example 3: Sentence Completion

Content Objective: V2A

The purported goal of gene-splicing is to increase an organism's _____ in some way, such as making a mouse a better model for a human disease or making a plant more resistant to insects or drought.

A. productivity

[Would not necessarily result from an animal being a better model for a human disease.]

B. status

[Would not necessarily result from either example.]

C. prosperity

[Would not necessarily result from an animal being a better model for a human disease.]

D. usefulness *

[CA: The examples of gene splicing in the second part of the sentence suggest that the goals of gene splicing include providing animal “models” of human diseases and improving the hardiness plants, both of which make them more useful to people.]

Verbal Ability Example 4: Sentence Completion

Content Objective: V2D

Located deep in the dermis, sweat glands help regulate body temperature by _____ fluid containing salt, water, and waste products, and then sending it through ducts to pores on the skin's surface where it is _____ as perspiration.

A. controlling . . . absorbed

[Waste products are not absorbed by pores; they are secreted.]

B. producing . . . evaporated

[Waste products are not released through evaporation by pores on the skin's surface.]

C. collecting . . . secreted *

[CA: Salt, water, and waste products in the dermis must first be collected by the sweat glands before they can be secreted or released from the body in the form of perspiration.]

D. transforming . . . processed

[Neither word applies to the mechanism of sweat glands and pores.]

Biology

Biology Objectives	
B1. General Biology	B2. Microbiology
A. Cellular and Molecular Biology <ol style="list-style-type: none"> 1. Structure and functions of cells 2. Gene expression 3. Cell division and growth 4. Energy transformations 5. Metabolism 	A. Microorganisms B. Infectious Diseases & Prevention C. Microbial Ecology D. Medical Microbiology E. Immunity
B. Diversity of Life Forms	B3. Human Anatomy and Physiology
B. Diversity of Life Forms <ol style="list-style-type: none"> 1. Genetics 	A. Structure <ol style="list-style-type: none"> 1. Cells 2. Tissues 3. Organs
F. Health	B. Systems
F. Health <ol style="list-style-type: none"> 1. Nutrition 2. Diseases 3. Drugs 	B. Systems <ol style="list-style-type: none"> 1. Skeletal/muscular/nervous 2. Circulatory/respiratory 3. Excretory/digestive 4. Endocrine/reproductive 5. Integumentary/immune

Examples of Biology Items

- Each Biology item stem will be in the form of a question (followed by a question mark) or in the form of an incomplete sentence that requires completion (with no end punctuation).
- Options may contain more than one concept or piece of information but each one will plausibly relate to the stem.

In the following sample Biology items, the correct answer for each item is followed by an asterisk (*), and each answer option is followed by a bracketed explanation for why it is correct (CA) or incorrect (neither of which will appear in the actual test).

Biology Example 1

Content Objective: B2E

Any molecular configuration that triggers the formation of the lymphocyte immune response and is itself the target is called a(n)

A. leukocyte.

[A leukocyte is a white blood cell and not the target of an infection from a foreign molecule.]

B. eosinophil.

[Eosinophil is a type of white blood cell that is involved in the immune response to parasitic infections or allergic reactions and not the target of infection from a foreign molecule.]

C. immunoglobulin.

[Immunoglobulins are antibodies formed by B cells and not the targets of an infection from a foreign molecule.]

D. antigen. *

[CA: Antigen is the correct term for anything that is the target of the immune response, causing production of antibodies by the living organism. Antigens can include foreign pollen, bacteria, viruses, proteins, and some other materials.]

Example 2

Content Objective: B1F2

Emphysema is a lung disease that impairs the exchange of oxygen and carbon dioxide, resulting in which condition?

A. Respiratory alkalosis

[Respiratory alkalosis is due to alveolar hyperventilation leading to decreased plasma carbon dioxide concentration. It develops when the lungs remove more carbon dioxide than is produced in the tissues. It is a common finding in patients receiving medical ventilation. Emphysema results in a decreased expulsion of carbon dioxide.]

B. Metabolic alkalosis

[This conditions results from an altered metabolism. A decreased hydrogen ion concentration results in increased bicarbonate and carbon dioxide concentrations. It occurs most commonly when a person has been vomiting profusely. Emphysema results in a decreased expulsion of carbon dioxide.]

C. Respiratory acidosis *

[This is the correct answer. Respiratory acidosis is a clinical disturbance that is due to alveolar hypoventilation. It results in low blood pH due to decreased clearance of carbon dioxide by the lungs. This condition occurs in emphysema as exhalation becomes insufficient.]

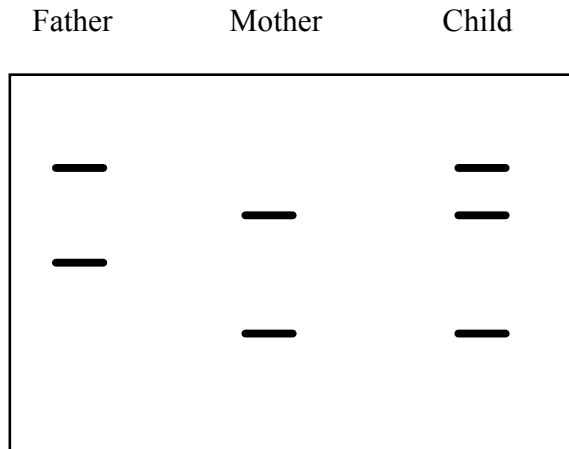
D. Metabolic acidosis

[Metabolic acidosis is a condition in which the blood pH is low due to increased production of hydrogen ions by the body or the inability of the body to form bicarbonate in the kidney. Emphysema results in a decreased expulsion of carbon dioxide.]

Biology Example 3

Content Objective: B1B1

A child is born with trisomy 21. DNA testing using a polymorphic DNA marker for chromosome 21 revealed the pattern exhibited in the Southern blot below.



At which meiotic division did nondisjunction occur?

A. Maternal meiotic division I *

[CA: Nondisjunction is an error that can occur during meiosis or mitosis, causing the daughter cells to have too many or too few chromosomes. Because the child has two maternal alleles that are not identical and one paternal allele, nondisjunction occurred at this stage of division.]

B. Paternal meiotic division I

[If nondisjunction occurred here, the child would have two paternal alleles and one maternal allele.]

C. Maternal meiotic division II

[If nondisjunction had occurred here, the maternal contribution would have been either no allele or two of the same kind.]

D. Paternal meiotic division II

[If nondisjunction had occurred here, the paternal contribution would have been either no allele or two of the same kind. Since there are two that appear to be of maternal origin, there is only one of paternal origin.]

Biology Example 4

Content Objective: B3B3

Which sphincter in the gastrointestinal tract controls movement of chyme from the stomach into the small intestine?

A. Cardiac

[The cardiac sphincter (lower esophageal sphincter) is located at the junction of the esophagus and the stomach.]

B. Pyloric *

[CA: The pyloric sphincter separates the stomach from the duodenum, the first division of the small intestine. The pyloric sphincter normally is in a contracted state, and retains food within the stomach until it has been broken down mechanically and chemically into chyme that can be passed into the duodenum of the small intestine.]

C. Ileocecal

[The ileocecal sphincter is located at the junction of the small intestine (ileum) and the large intestine.]

D. Anal

[The anal sphincter is located at the end of the rectum.]

Chemistry

Chemistry Objectives	
C2. General Chemistry	C3. Organic Chemistry
A. Atomic Theory 1. Structure 2. Ions 3. Periodicity	A. Structure and Properties 1. Structural formulas and bonding 2. Properties of organic compounds
B. Chemical Bonding 1. Nomenclature/formulas 2. Bonding	B. Reactions of Organic Compounds 1. Oxidation–reduction reactions 2. Hydration and dehydration 3. Hydrolysis 4. Addition/substitution/elimination
C. Reactions and Reaction Mechanisms 1. Types of reactions 2. Balancing equations 3. Equilibrium 4. Stoichiometry	C4. Basic Biochemistry Processes
D. Kinetic Theory 1. States of matter 2. Gas laws 3. Causes and effects of changes in states	A. DNA and RNA
E. Solutions 1. Concentration (pH) 2. Solubility 3. Acid–base theories	B. Lipids
G. Nuclear Chemistry: Radioisotopes	C. Proteins

Examples of Chemistry Items

- Each Chemistry item stem will be in the form of a question (followed by a question mark) or in the form of an incomplete sentence that requires completion (with no end punctuation).
- Options may contain more than one concept or piece of information but each one will plausibly relate to the stem.

In the following sample Chemistry items, the correct answer for each item is followed by an asterisk (*), and each answer option is followed by a bracketed explanation for why it is correct (CA) or incorrect (neither of which will appear in the actual test).

Chemistry Example 1

Content Objective: C2D3

A student has a sample of a gas in a glass container with a movable piston. In order to convert this gas to a liquid, the student should

A. increase the inside pressure by decreasing the volume, lowering temperature as needed. *

[CA: These conditions will lead to the reduction in volume and kinetic energy needed to convert the sample to a liquid phase.]

B. transfer the gas to a container of larger volume.

[This will increase the volume and not move the sample toward the liquid state.]

C. increase the inside temperature by increasing the volume, decreasing pressure as needed.

[This will cause an increase in volume and kinetic energy and will not move the sample toward the liquid state.]

D. transfer the gas to a container of different shape.

[This will not affect the interactions between molecules.]

Chemistry Example 2

Content Objective: C2A3

The diagram below shows part of the periodic table with the first ionization energy given for arsenic (As).

Al	Si	P	S
Ga	Ge	As 947 kJ/ mol	Se
In	Sn	Sb	Te

Which elements are most likely to have an ionization energy that is 1,000 kilojoules/mole (kJ/mol) or higher?

A. Aluminum (Al) and silicon (Si)

[Though Al and Si are above As, they are both to the left and are not as likely to have IE's $\geq 1,000$ kJ/mol; Note: $IE_{Al} = 577$ kJ/mol and $IE_{Si} = 786$ kJ/mol.]

B. Indium (In) and tin (Sn)

[Both In and Sn are below and to the left of As, so $IE < 1000$ kJ/mol; Note: $IE_{In} = 558$ kJ/mol and $IE_{Sn} = 709$ kJ/mol.]

C. Antimony (Sb) and tellurium (Te)

[Antimony is below As, so $IE < 1000$ kJ/mol; and though Te is to the right, it is lower than As and not as likely to have an $IE \geq 1,000$ kJ/mol; Note: $IE_{Sb} = 834$ kJ/mol and $IE_{Te} = 869$ kJ/mol.]

D. Phosphorus (P) and sulfur (S) *

[CA: IE generally increases from left to right and going up the periodic table. Since P is above and S is above and to right of As, IE's are most likely $\geq 1,000$ kJ/mol; Note: $IE_P = 1,012$ kJ/mol and $IE_S = 1,000$ kJ/mol.]

Chemistry Example 3

Content Objective: C3B2

Which of the following products is formed when ethyne reacts with water and H_2SO_4 in the presence of mercuric sulfate HgSO_4 at $60\text{ }^\circ\text{C}$?

A. CH_2CH_2 [This would require a different set of reactants, namely, H_2 and a Lindlar catalyst.]**B.** CH_3CHO *

[CA: The hydration of ethyne breaks the triple bond and produces acetaldehyde (ethanal).]

C. CH_3CH_3 [This would require a different set of reactants, namely, H_2 and a Lindlar catalyst.]**D.** $\text{CH}_3\text{CH}_2\text{OH}$

[The candidate may have confused alkenes, which give alcohol products, with alkynes.]

Example 4

Content Objective: C4C

The loss of a secondary, tertiary, or quaternary protein structure due to the disruption of noncovalent interactions and/or disulfide bonds that leaves the primary structure intact is known as

A. esterification.

[Esterification is a reaction that usually involves the combination of an acid and an alcohol and leads to the production of an ether.]

B. denaturation. *

[CA: Denaturation is a biochemical process that involves an unfolding of a protein's secondary, tertiary, or quaternary structure but does not affect the primary structure. Denatured proteins can exhibit a wide list of changes, such as a decrease in solubility.]

C. saponification.

[Saponification is a reaction that involves the alkaline hydrolysis of an ester to produce soap and glycerin.]

D. dehydration.

[Dehydration is a reaction that usually involves the loss of water molecules.]

Reading Comprehension

Reading Comprehension Content Objectives
R1. Comprehension (recognition, understanding)
A. Words in Context (defining a term used in the passage)
B. Main Ideas (identifying or inferring the main idea of a paragraph or group of paragraphs)
C. Supporting Details (identifying facts or ideas explicitly stated in the passage)
D. Drawing Conclusions (making inferences from statements in the passage)
R2. Analysis (inference, interpretation)
A. Relationships Between Ideas (identifying relationships between ideas in different parts of a paragraph or in different paragraphs)
B. Author's Purpose (inferring the author's purpose for writing the entire passage or for including a statement in part of the passage)
C. Author's Tone (inferring author's attitude in the entire passage or in a specific statement in part of the passage)
D. Facts/Opinions (distinguishing between statements of fact and expressions of opinion)
E. Rhetorical Strategies (identifying methods used by the author for effect, to persuade, or to make a point)
R3. Evaluation (reasoned judgment)
A. Bias (inferring author's viewpoint, preference, or position in entire passage or in a specific statement in part of the passage)
B. Support in an Argument (evaluating the effectiveness of elements of support used by the author in the passage)
C. Author's Conclusion/Thesis (identifying or inferring the author's overall point in the passage, or evaluating how well the author's overall point follows from the support provided)

Examples of a Reading Comprehension Passage and Items

- Each PCAT Reading Comprehension passage will address historical or contemporary social, cultural, ethical, or political issues related to the social sciences, the natural sciences, technology, health, nutrition, or medicine.
- Passages may be informative, persuasive, or speculative in purpose or may be practical or theoretical in nature.
- Each reading item stem will clearly relate to the reading passage and will require understanding part or all of the passage in order to answer correctly.

- Each item stem may refer to a specific word, phrase, sentence, paragraph, or section of the passage or may refer to the passage as a whole.

Following the sample Reading Comprehension passage, the correct answer for each sample item is followed by an asterisk (*), and each answer option is followed by a bracketed explanation for why it is correct (CA) or incorrect (neither of which will appear in the actual test).

Reading Comprehension Passage Example

- 1 An interesting question has emerged from recent research involving calorie restriction and aging: Can a low-calorie diet help people live longer? Studies involving animals such as mice, worms, and fish have shown that eating a very low-calorie diet can prevent such ailments as heart disease, diabetes, and some cancers and can actually extend life spans. The reasons for these results are not adequately understood, and scientists are uncertain whether the same results can occur in humans. However, some promising research findings are beginning to appear.
- 2 In studies conducted at the University of California, Riverside (UCR), researchers have found that by decreasing the intake of calories in laboratory mice, regardless of the time period involved, most diseases caused by aging are prevented. Based on findings from their most recent studies, these researchers suggest that it is possible to help avoid heart disease, cancer, and diabetes simply by restricting caloric intake for as short a time as four weeks. The UCR researchers have also found that a chemical change takes place in the body through calorie restriction, and suggest that it is possible to duplicate this change through the use of pharmaceuticals.
- 3 Research is also beginning to reveal some interesting findings involving low-calorie diets and humans. Several studies have been conducted within human populations in Okinawa, Japan. Results of these studies have shown that individuals under the age of sixty show very little serious disease, and that there are forty times as many residents of Okinawa living 100 years or longer than in more northeastern areas of Japan. Studies have concluded that a lower calorie intake appears to be the main difference in the eating habits of Okinawans.
- 4 In findings published in 2006, researchers at the Pennington Biomedical Research Center at Louisiana State University reported a study involving forty-eight overweight humans, in which people on a six-month calorie-restricted diet showed several improvements in health markers associated with aging. In this study, one group of twelve individuals followed a diet with a 25 percent calorie restriction from the usual daily calorie amount. Another group combined a 12.5 percent increase in exercise with a 12.5 percent reduction in calorie intake. A third group followed an 890-calorie liquid diet for three months, followed by a weight-maintenance diet. A control group attempted to merely maintain steady weight. While no changes were observed in the control group, the preliminary results of this study found that individuals who followed a strict low-calorie diet

showed decreased amounts of age-related DNA damage when compared to initial levels.

- 5 Based on the findings of studies such as these, the effects of a low-calorie diet on the aging process appear quite positive. An especially encouraging result of these studies is the possibility of developing pharmaceuticals that can duplicate the chemical changes produced in the body from calorie restriction. Although more research is clearly needed, promising findings so far suggest that following a calorie-restricted diet can very possibly help us avoid many of the diseases that now plague us as we grow older, and thus lead to longer, healthier lives.

Reading Comprehension Example Item 1

Content Objective: R1B

What main point from the passage is supported by the following statement in the second paragraph: “. . . these researchers suggest that it is possible to help avoid heart disease, cancer, and diabetes simply by restricting caloric intake for as short a time as four weeks.”

- A.** It seems that heart disease, cancer, and diabetes are all directly tied to diet.
[The author never states this unequivocally but simply as a growing theory.]
- B.** Improvements are often seen for patients with chronic diseases in a relatively short amount of time.
[The four-week time period is referring to the amount of time calories were restricted, not diseases.]
- C.** Preliminary research indicates that major diseases may be affected by calorie intake. *
[CA: The author is showing that early research had found correlations between caloric intake and incidence of major diseases.]
- D.** Many serious diseases can be avoided if a person makes sufficient effort to avoid them.
[This is never stated or implied anywhere in the passage.]

Reading Comprehension Example Item 2

Content Objective: R2D

Which words from the passage indicate the author's opinion?

- A.** “. . . recent research . . .” (Paragraph 1)
[Neither word implies any kind of an opinion.]
- B.** “. . . adequately understood . . .” (Paragraph 1)
[Though the word “adequately” could show opinion, in this context it does not.]
- C.** “. . . preliminary results . . .” (Paragraph 4)
[Neither word implies any kind of an opinion.]
- D.** “. . . quite positive.” (Paragraph 5) *
[CA: This is correct because the word “quite” implies a judgment or opinion, and the word “positive” suggests the author's view.]

Reading Comprehension Example Item 3

Content Objective: R2E

What strategy does the author use throughout the passage to support the overall thesis?

- A.** Adding personal anecdotes to highlight the best way to restrict calories
[There are no personal stories in the passage.]
- B.** Referring to respected publications for additional facts and statistics
[There are no references to publications in the passage.]
- C.** Listing results from prestigious studies to add credibility *
[CA: The author mentions several studies to support the main point.]
- D.** Repeating key words to link diverse and unique ideas together
[There is no obvious repetition and no truly diverse ideas.]

Reading Comprehension Example Item 4

Content Objective: R3B

Which point from the passage best supports the author's suggestion that a low-calorie diet may be able to extend the average life span?

A. Research subjects on a calorie-restricted diet showed decreased amounts of age-related DNA damage. *

[CA: This shows that calorie restriction does affect the basic DNA.]

B. Many Okinawans live to be more than 100 years old.

[Although the statement is true, it does not prove anything about a low-calorie diet.]

C. Studies conducted on mice, worms, and fish have shown that calorie reduction prevents age-related diseases.

[The fact that changes happened in various animals proves nothing for the therapy's use with humans.]

D. A chemical change takes place in the body when calories are sufficiently restricted.

[The fact that a chemical change occurs does not mean that the life span will be extended.]

Quantitative Ability

Quantitative Ability Content Objectives
Q1. Basic Math
A. Fractions, Percentages, & Decimals
B. Unit Conversions
C. Log Base 10
Q3. Algebra
G. Expressions, Equations, and Inequalities
<ol style="list-style-type: none"> 1. Evaluate algebraic expressions for given values 2. Represent verbal quantitative situations as algebraic expressions or equations 3. Solve problems using linear equations and inequalities 4. Solve problems using equations and inequalities involving absolute value 5. Solve problems using equations and inequalities involving rational expressions 6. Solve quadratic equations and inequalities 7. Solve equations and inequalities involving 1 or 2 radicals 8. Solve systems of equations or inequalities involving 2 or 3 variables
I. Functions
<ol style="list-style-type: none"> 1. Perform algebraic operations on functions 2. Determine compositions of functions 3. Determine inverses of functions 4. Determine and use maximum and minimum points
Q4. Probability & Statistics
A. Measures of Central Tendency
B. Variation
C. Graphical
D. Probability
E. Statistical Concepts

Quantitative Ability Content Objectives <i>(continued)</i>
Q5. Precalculus
A. Functions
<ol style="list-style-type: none"> 1. Graph and identify domains, ranges, intercepts, and zeros of exponential functions 2. Logarithms (natural or other base with multiple operations) 3. Solve problems related to exponential and logarithmic functions 4. Graph and identify domains, ranges, intercepts, zeros, and inverses of the circular functions 5. Perform algebraic operations on functions 6. Identify and use composite functions
B. Complex Numbers
C. Vectors
<ol style="list-style-type: none"> 1. Add vectors graphically and algebraically 2. Perform scalar multiplications 3. Represent and/or recognize vector equations of lines and planes
Q6. Calculus
A. Limits (Find: Limits of functions, One-sided limits, Infinite limits)
B. Continuity (Interpret graphs of continuous and discontinuous functions)
C. Derivatives
<ol style="list-style-type: none"> 1. Find derivatives of algebraic functions by means of the Sum and product, Power rule, apply the Mean Value Theorem 2. Use the Chain Rule to find derivatives of composite functions 3. Solve problems by differentiation (e.g., velocity and acceleration) 4. Use and/or interpret derivative tests to find extrema, points of inflection, intervals 5. Interpret and/or use the derivatives of circular functions and their inverses 6. Interpret and/or use the derivatives of transcendental functions 7. Determine the derivatives of composite functions involving the circular and transcendental functions 8. Use implicit differentiation 9. Determine related rates
D. Integrals
<ol style="list-style-type: none"> 1. Find antiderivatives, and interpret C 2. Understand and use sigma notation for simplifying sums 3. Approximate areas bounded by curves
E. Integration

Examples of Quantitative Ability Items

- Each Quantitative Ability item stem will be in the form of a question (followed by a question mark), in the form of an incomplete sentence that requires completion (with no end punctuation), or in the form of an incomplete statement that ends in an equals sign (=).
- Options may contain more than one concept or piece of information but each one will plausibly relate to the stem.

In the following sample Quantitative Ability items, the correct answer for each item is followed by an asterisk (*), and each answer option is followed by a bracketed explanation for why it is correct (CA) or incorrect (neither of which will appear in the actual test).

Quantitative Ability Example 1

Content Objective: Q3G7

Let c be a constant. The lines $2x - y = 5$ and $x - y = c$ intersect in a unique point (r, s) in the coordinate plane. In which way does increasing the value of c affect the values of r and s ?

A. The values of r and s both decrease. *

[CA: Solve the system by eliminating y ; subtract the second equation from the first equation to get $x = 5 - c$; then substitute into the equation $x - y = c$ to get $5 - c - y = c$; $y = 5 - 2c$. So, $r = 5 - c$; $s = 5 - 2c$; both r and s decrease with c because the coefficient of c is negative in the expressions for r and s .]

B. The value of r increases; the value of s decreases.

[The candidate chooses the wrong direction of change for r .]

C. The values of r and s both increase.

[The candidate chooses the wrong directions of change for both r and s .]

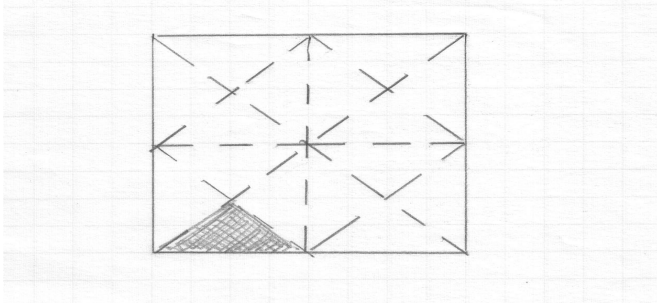
D. The value of r decreases; the value of s increases.

[The candidate chooses the wrong direction of change for s .]

Quantitative Ability Example 2

Content Objective: Q1A

A student folded a square sheet of paper in half four times and then unfolded it. The dashed lines in the figure below show where the student folded the sheet of paper.



Before the student unfolded the paper, it looked like the shaded triangle. Which is closest to the percent of the sheet of paper that is the shaded triangle?

A. 4%

[The candidate thinks that the paper was folded in half four times and that this equals 4%.]

B. 6% *

[CA: Solve by first determining that the shaded area is $\frac{1}{16}$ of the sheet of paper:

$$\frac{1}{16} = 0.0625 = 6.25\%.]$$

C. 15%

[The candidate thinks the 15 unshaded triangles represent 15%.]

D. 16%

[The candidate thinks that the 16 triangles represent 16%.]

Quantitative Ability Example 3

Content Objective: Q4A

A student took five measurements of the freezing point of an unknown chemical solution. The mean of the first four measurements was $-8.40\text{ }^{\circ}\text{C}$, and the fifth measurement was $-9.00\text{ }^{\circ}\text{C}$. What was the mean of the student's five measurements of the freezing point?

A. $-8.88\text{ }^{\circ}\text{C}$

[The candidate finds the temperature that is one-fifth of the way from $-9.00\text{ }^{\circ}\text{C}$ to $-8.40\text{ }^{\circ}\text{C}$, rather than from $-8.40\text{ }^{\circ}\text{C}$ to $-9.00\text{ }^{\circ}\text{C}$.]

B. $-8.70\text{ }^{\circ}\text{C}$

[The candidate simply averages $-8.40\text{ }^{\circ}\text{C}$ and $-9.00\text{ }^{\circ}\text{C}$.]

C. $-8.55\text{ }^{\circ}\text{C}$

[The candidate finds the temperature that is one-quarter rather than one-fifth of the way from $-8.40\text{ }^{\circ}\text{C}$ to $-9.00\text{ }^{\circ}\text{C}$.]

D. $-8.52\text{ }^{\circ}\text{C}$ *

[CA: One way to do this is to find the temperature one-fifth of the way from $-8.40\text{ }^{\circ}\text{C}$ to $-9.00\text{ }^{\circ}\text{C}$. Another way is to realize that the sum of the first four measurements (in $^{\circ}\text{C}$) was $4(-8.40)$, conclude that the sum of all the measurements was $4(-8.4) + (-9.00)$, and then divide this result by 5 to obtain the mean of all five measurements.]

Quantitative Ability Example 4

Content Objective: Q5A2

If $\ln e^{2x+1} = 9$, what is the value of x ?

A. $\frac{(-1 + \ln 9)}{2}$

[The candidate makes a mistake and assumes that $2x + 1 = \ln 9$, then solves the equation and gets $\frac{(-1 + \ln 9)}{2}$.]

B. 4 *

[CA: The natural logarithmic function and the exponential function are inverse functions. Therefore, $\ln e^{2x+1} = (2x + 1) \cdot \ln e = 2x + 1$. So, $2x + 1 = 9 \Rightarrow 2x = 8 \Rightarrow x = 4$.]

C. $\left[\frac{9}{(2)(\ln e)} \right]$

[The candidate makes a mistake and assumes that $\ln e^{2x+1} = 2 \ln e$, then solves the equation and gets $\left[\frac{9}{(2)(\ln e)} \right]$.]

D. 23

[The candidate makes a computational error.]

Quantitative Ability Example 5

Content Objective: Q6C1

If $f(x) = e^{\sqrt{x+1}}$, what is $f'(3)$?

A. $\frac{e}{4}$

[The candidate makes a computational error and does not find the correct numerator.]

B. $\frac{e^2}{4}$ *

[CA: First we find the derivative:

$$f'(x) = e^{\sqrt{x+1}} \cdot \frac{d}{dx}(\sqrt{x+1}) = e^{\sqrt{x+1}} \cdot \frac{1}{2}(x+1)^{-1/2} = \frac{e^{\sqrt{x+1}}}{2\sqrt{x+1}}$$

Therefore, if we evaluate the derivative at $x = 3$, we have:

$$f'(3) = \frac{e^{\sqrt{3+1}}}{2\sqrt{3+1}} = \frac{e^{\sqrt{4}}}{2\sqrt{4}} = \frac{e^2}{2 \cdot 2} = \frac{e^2}{4}. \text{ Thus, } f'(3) = \frac{e^2}{4} .]$$

C. $\frac{e^2}{2}$

[The candidate does not find the derivative correctly and forgets a factor of 2 in the denominator.]

D. e^2

[The candidate does not find the derivative correctly.]

Writing

Writing Prompt Content Objectives
A. Health Issues (issues related to public health, medicine, nutrition, fitness, prevention, treatments, therapies, medications, drugs, attitudes)
B. Science Issues (issues related to research, theories, findings, applications, controversies, education, attitudes)
C. Social, Cultural, or Political Issues (issues related to beliefs, attitudes, behaviors, trends, laws, policies)

Examples of Writing Prompts

- Each writing prompt will be in the form of a statement that presents a contemporary problem relating to one of the general Content Objectives listed above.
- The problem referred to in each prompt may be specific but will also be universal enough that it does not require extensive background in the history, politics, or situation of any particular region of the world.

Writing Prompt Example 1

Content Objective Code: A

Discuss a solution to the problems resulting from insufficient supplies of donated human organs for those in need of transplants.

Writing Prompt Example 2

Content Objective Code: A

Discuss a solution to the problem of providing adequate health care for uninsured individuals.

Writing Prompt Example 3

Content Objective Code: A

Discuss a solution to the problem of promoting healthy dietary habits among a population.

Writing Prompt Example 4

Content Objective Code: B

Discuss a solution to the problem of developing affordable alternatives to gasoline as a means of powering personal automobiles.

Writing Prompt Example 5

Content Objective Code: B

Discuss a solution to the problem of dealing with global warming in a world dependent on fossil fuels for energy.

Writing Prompt Example 6

Content Objective Code: B

Discuss a solution to the problem of protecting endangered species from increasing human development.

Writing Prompt Example 7

Content Objective Code: C

Discuss a solution to the problems involved in raising children in a country that allows few restrictions on the mass media.

Writing Prompt Example 8

Content Objective Code: C

Discuss a solution to the problem of preventing terrorist attacks in a country, such as the United States, that traditionally imposes few restrictions on individual freedom.

Writing Prompt Example 9

Content Objective Code: C

Discuss a solution to the problem of establishing fair immigration policies that address both the interests of immigrants and the interests of citizens already living in the country.