Strategies for the SAT and ACT

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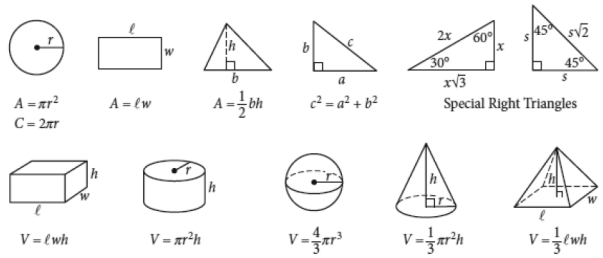
If you have questions, feel free to e-mail me at MShagam@gmail.com.

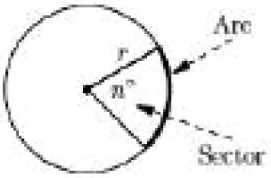
Basic & Advanced Formulas for the SAT/ACT

SAT Formula Bank



The number of degrees of arc in a circle is 360.
The number of radians of arc in a circle is 2π.
The sum of the measures in degrees of the angles of a triangle is 180.

Additional Circle Formulas



(Optional)

Length Of Arc = $(n°/360°) \cdot 2\pi r$

Area Of Sector = $(n°/360°) \cdot \pi r^2$

Coordinate Form: $(x - h)^2 + (y - k)^2 = r^2$

with the center at (h, k) and the radius r

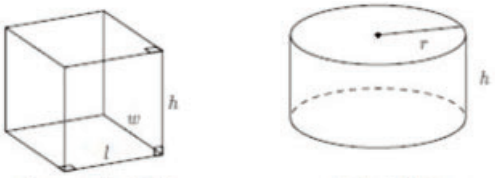
Coordinate Graphing Equations

Distance from A to B: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Mid-point of the segment $\overline{AB}$: $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Slope of the line: $\frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$

3d Geometry Formulas



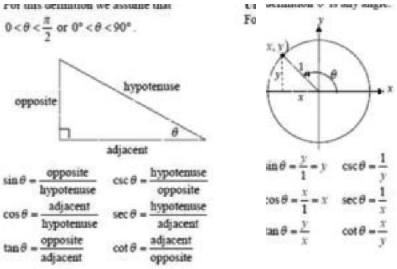
Rectangular Solid

Volume = lwh

Right Cylinder

Volume = $\pi r^2 h$

Definition of Trig Functions



Polynomial Formula

$(x + a)(x + b) = x^2 + (b + a)x + ab$ "FOIL"

Quadratic Equation

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

Polynomial Long Division

$$\begin{array}{r} x^2 + 2x - 2 \\ 2x + 3 \overline{)\,2x^3 + 7x^2 + 2x + 9} \\ \underline{2x^3 + 3x^2} \\ 4x^2 + 2x \\ \underline{4x^2 + 6x} \\ -4x + 9 \\ \underline{-4x - 6} \\ 15 \end{array}$$

Exponent Rules

$x^a \cdot x^b = x^{a+b}$ $\quad x^a / x^b = x^{a-b}$ $\quad 1/x^b = x^{-b}$

$(x^a)^b = x^{a \cdot b}$ $\quad (xy)^a = x^a \cdot y^a$ $\quad (-1)^n = \begin{cases} +1, & \text{if } n \text{ is even;} \\ -1, & \text{if } n \text{ is odd.} \end{cases}$

$x^0 = 1$ $\quad \sqrt{xy} = \sqrt{x} \cdot \sqrt{y}$

Imaginary Numbers Raised to Progressive Powers

$i^0 = 1$

$i^1 = i$

$i^2 = -1$

$i^3 = -1 \bullet i = -i$

$i^4 = -i \bullet i = -i^2 = -(-1) = 1$

"Grab bag" topics

- imaginary numbers
- matrices
- permutations and combinations
- logic
- sets
- arithmetic and geometric sequences

Active Reading Annotation Example & Questions

NATURAL SCIENCE: This passage is adapted from the article "Needles & Nerves" by Catherine Dold (©1999 by The Walt Disney Company).

Acupuncture and other forms of traditional Chinese medicine have been around for more than 4,000 years. Yet the explanation for how acupuncture—and Chinese medicine as a whole—works has long been a mystery for most Western doctors. The basic theory is outlined in a text from 200 B.C. It recognizes in people and in nature a vital energy or life force known as qi. Qi is the source of movements ranging from voluntary muscle action to blood flow; it protects the body from external influences, and it generates warmth. Qi flows through the body and to the organs by way of an extensive system of channels known as meridians. If the flow of the force is disturbed, the theory goes, the resulting deficiency, excess, or stagnation of qi causes bodily malfunction and thus illness.

Acupuncture, in which needles are inserted into specific points along the meridians and manipulated, is said to restore the proper flow of qi and thereby return the body to health. Practitioners recognize some 1,500 acupoints, most of which have no obvious relationship to their intended targets. For example, a point on the second toe is used to treat headaches and toothaches, while a point near the elbow enhances the immune system.

Another integral concept is the tension between two ever-present, complementary forces of nature, yin and yang. When their balance is disturbed, the theory goes, people get sick. Yin conditions reflect a lack of qi: pale face, cold extremities, slow pulse, depression. Yang conditions result from an excess of qi: red face, fever, fast pulse, agitation.

Doctors and licensed practitioners administer between 9 and 12 million acupuncture treatments each year in the United States, commonly for pain control.

According to neuroscientist Bruce Pomeranz, of the University of Toronto, numerous studies over the past 20 years have shown that inserting needles into acupoints stimulates nerves in the underlying muscles. That stimulation, researchers believe, sends impulses up the spinal cord to a relatively primitive part of the brain known as the limbic system, as well as to the midbrain and the pituitary gland. Somehow this signaling leads to the release of endorphins and monoamines, chemicals that block pain signals in the spinal cord and the brain.

"The endorphin story is really nailed down," says Pomeranz. "The acupoints that have been mapped over thousands of years are likely the spots where nerves are concentrated." But the endorphin story "doesn't explain many of the other claims of acupuncture," he continues. "There have been a number of clinical trials showing that acupuncture is extremely useful for the nausea caused by chemotherapy and early pregnancy. That's not the endorphin system."

Nor does the endorphin story explain what physicist Zang-Hee Cho found when exploring acupoints that are traditionally used to treat vision problems. The points are not found near the eyes but on the outside of the foot, running from the little toe to the ankle. Acupuncturists hold that stimulation of these points with needles will affect the eyes via the system of meridians rather than through the central nervous system.

To test that premise, Cho strapped student volunteers into an fMRI (functional magnetic resonance imaging) machine, the results from which can be viewed as colorful brain activation maps. Cho first stimulated the eyes of the volunteers by flashing a light in front of them. The resulting images, as expected, showed a concentration of color—an increase in activity—in the visual cortex, the portion of the brain that is known to be involved in eye function. Then Cho had an acupuncturist stimulate one of the vision-related acupoints. In one person after another, the very same region of the brain lit up on the fMRI image. The magnitude of brain activity seen on acupuncture stimulation was nearly as strong as that elicited by the flash of light. To eliminate the possibility of a placebo effect, Cho also stimulated a nonacupoint, in the big toe. There was no response in the visual cortex.

Like many preliminary scientific reports, Cho's study raises more questions than it answers. Still, he has demonstrated new functional effects of acupuncture. "Classically, acupuncture was the ultimate in experimentation; people collected data for thousands of years," says Joie Jones, professor of radiological sciences at the University of California at Irvine and coauthor of the study. "With these studies, we've demonstrated that for at least some acupuncture points a connection goes through the brain."

Acupuncture affects brain.

31. The passage mentions that the onset of illness would be caused by any of the following EXCEPT:
    - A. a shortage of qi.
    - B. an excess of qi.
    - C. a change in the temperature of qi.
    - D. a disruption in the flow of qi.

32. According to the fifth paragraph (lines 35–45), studies have shown that the insertion of acupuncture needles into acupoints causes nerve stimulation that results in:
    - F. signals being sent to the brain and pituitary gland, which leads to the release of chemicals.
    - G. signals being sent to the spinal cord, which immediately blocks the release of chemicals.
    - H. chemicals being released that amplify signals to the spinal cord.
    - J. chemicals being released that numb the spinal cord and prevent signals being sent to the brain and pituitary gland.

33. The studies of acupuncture described in the fifth paragraph (lines 35–45) can best explain the success of acupuncture in treating which of the following conditions?
    - A. Blurred vision
    - B. Nausea
    - C. Headaches
    - D. Impaired immune system

34. According to the passage, the study by Cho showed that volunteers experienced an increase in visual cortex activity when they:
    - F. viewed brain activation maps.
    - G. were exposed to high concentrations of color.
    - H. received acupoint stimulation to their big toes.
    - J. underwent acupoint stimulation of the outside of the foot.

35. Information in the last paragraph indicates that acupuncture research has given results that:
    - A. thoroughly explain the mechanisms by which acupuncture functions.
    - B. explain some aspects of how acupuncture functions while leaving other aspects open to further study.
    - C. explain some aspects of how acupuncture functions while questioning the methods used in previous studies.
    - D. do not explain any of the mechanisms by which acupuncture functions.

36. The passage indicates that the balance between yin and yang in a person depends on that person's:
    - F. emotional state.
    - G. blood flow.
    - H. pulse.
    - J. level of qi.

37. According to the passage, a person with a yang condition might exhibit all of the following EXCEPT:
    - A. pale face.
    - B. agitation.
    - C. fast pulse.
    - D. fever.

38. As it is used in line 49, the word *concentrated* most nearly means:
    - F. extracted.
    - G. paid attention to.
    - H. gathered together.
    - J. directed to one topic.

39. According to the passage, Cho would have determined that volunteers had experienced a placebo effect if which of the following procedures had created increased activity in the visual cortex of the brain?
    - A. Flashing a light in front of them
    - B. Stimulating one of their vision-related acupoints
    - C. Having them read an eye-examination chart
    - D. Stimulating a place that was not a visual acupoint

40. In the last paragraph, the author expresses the belief that scientists who open a new line of research on a topic are likely to:
    - F. quickly discover the answers to the questions they raise.
    - G. find that new questions arise as old ones are answered.
    - H. receive answers far different than they anticipated.
    - J. learn that they have often asked the wrong questions.

Writing: Essays

Both tests offer an essay section. Both are optional. The SAT requires a *writing analysis* essay which centers on explaining what choices an author made in writing a persuasive essay, while the ACT essay is a *persuasive* essay.

- a thesis paragraph
- three body/evidence paragraphs
- a conclusion paragraph

In addition, the ACT's format strongly rewards students who include a rebuttal paragraph, addressing the opinion contrary to the student's thesis. On the ACT, students are graded by two human readers, while the new SAT uses three. All readers are trained to look for a clear, consistent thesis, supported by evidence, in a clearly organized, generally grammar error-free format; think "good first draft" level of quality.

The SAT essay, by comparison, is about evaluating a long essay and answering how an author "uses evidence, such as facts or examples, to support claims; reasoning to develop ideas and to connect claims and evidence; and stylistic or persuasive elements, such as word choice or appeals to emotion, to add power to the ideas expressed."

SAT Essay

Adapted from Paul Bogard, "Let There Be Dark." ©2012 by *Los Angeles Times,* published December 21, 2012.

> At my family's cabin on a Minnesota lake, I knew woods so dark that my hands disappeared before my eyes. I knew night skies in which meteors left smoky trails across sugary spreads of stars. But now, when 8 of 10 children born in the United States will never know a sky dark enough for the Milky Way, I worry we are rapidly losing night's natural darkness before realizing its worth. This winter solstice, as we cheer the days' gradual movement back toward light, let us also remember the irreplaceable value of darkness . . .

ACT Essay

> Many of the goods and services we depend on daily are now supplied by intelligent, automated machines rather than human beings. Robots build cars and other goods on assembly lines, where once there were human workers. Many of our phone conversations are now conducted not with people but with sophisticated technologies. We can now buy goods at a variety of stores without the help of a human cashier. Automation is generally seen as a sign of progress, but what is lost when we replace humans with machines? Given the accelerating variety and prevalence of intelligent machines, it is worth examining the implications and meaning of their presence in our lives.

Read and carefully consider these perspectives. Each suggests a particular way of thinking about the increasing presence of intelligent machines.

Perspective 1

What we lose with the replacement of people by machines is some part of our own humanity. Even our mundane daily encounters no longer require from us basic courtesy, respect, and tolerance for other people.

Perspective 2

Machines are good at low-skill, repetitive jobs, and at high-speed, extremely precise jobs. In both cases they work better than humans. This efficiency leads to a more prosperous and progressive world for everyone.

Perspective 3

Intelligent machines challenge our long-standing ideas about what humans are or can be. This is good because it pushes both humans and machines toward new, unimagined possibilities.