1960 AHSME Problems

Problem 1

If 2 is a solution (root) of $x^3+hx+10=0$, then h equals:

$\textbf{(A)}10 \qquad \textbf{(B) }9 \qquad \textbf{(C) }2 \qquad \textbf{(D) }-2 \qquad \textbf{(E) }-9$

Problem 2

It takes 5 seconds for a clock to strike 6 o'clock beginning at $6:00$ o'clock precisely. If the strikings are uniformly spaced, how long, in seconds, does it take to strike 12 o'clock?

$\textbf{(A)}9\frac{1}{5} \qquad \textbf{(B) }10 \qquad \textbf{(C) }11 \qquad \textbf{(D) }14\frac{2}{5} \qquad \textbf{(E) }\text{none of these}$

Problem 3

Applied to a bill for $\$10,000$ the difference between a discount of 40% and two successive discounts of 36% and 4%, expressed in dollars, is:

$\textbf{(A)}0 \qquad \textbf{(B) }144 \qquad \textbf{(C) }256 \qquad \textbf{(D) }400 \qquad \textbf{(E) }416$

Problem 4

Each of two angles of a triangle is 60° and the included side is 4 inches. The area of the triangle, in square inches, is:

$\textbf{(A)}8\sqrt{3} \qquad \textbf{(B) }8 \qquad \textbf{(C) }4\sqrt{3} \qquad \textbf{(D) }4 \qquad \textbf{(E) }2\sqrt{3}$

Problem 5

The number of distinct points common to the graphs of $x^2+y^2=9$ and $y^2=9$ is:

$\textbf{(A)}\text{infinitely many} \qquad \textbf{(B) }\text{four} \qquad \textbf{(C) }\text{two} \qquad \textbf{(D) }\text{one} \qquad \textbf{(E) }\text{none}$

Problem 6

The circumference of a circle is 100 inches. The side of a square inscribed in this circle, expressed in inches, is:

$\textbf{(A)}\frac{25\sqrt{2}}{\pi} \qquad \textbf{(B) }\frac{50\sqrt{2}}{\pi} \qquad \textbf{(C) }\frac{100}{\pi} \qquad \textbf{(D) }\frac{100\sqrt{2}}{\pi} \qquad \textbf{(E) }50\sqrt{2}$

Problem 7

Circle I passes through the center of, and is tangent to, circle II. The area of circle I is 4 square inches. Then the area of circle II, in square inches, is:

$\textbf{(A)}8 \qquad \textbf{(B) }8\sqrt{2} \qquad \textbf{(C) }8\sqrt{\pi} \qquad \textbf{(D) }16 \qquad \textbf{(E) }16\sqrt{2}$

Problem 8

The number $2.5252525\ldots$ can be written as a fraction. When reduced to lowest terms the sum of the numerator and denominator of this fraction is:

$\textbf{(A)}7 \qquad \textbf{(B)}29 \qquad \textbf{(C)}141 \qquad \textbf{(D)}349 \qquad \textbf{(E)}\text{none of these}$

Problem 9

The fraction $\frac{a^2+b^2-c^2+2ab}{a^2+c^2-b^2+2ac}$ is (with suitable restrictions of the values of a, b, and c):

(A) irreducible

$\text{(B) reducible to negative 1}$

$\text{(C) reducible to a polynomial of three terms}$

$\text{(D) reducible to} \frac{a-b+c}{a+b-c}$

$\text{(E) reducible to} \frac{a+b-c}{a-b+c}$

Problem 10

Given the following six statements:
$\text{(1) All women are good drivers}\text{(2) Some women are good drivers}\text{(3) No men are good drivers}\text{(4) All men are bad drivers}\text{(5) At least one m}$

The statement that negates statement (6) is:

$\textbf{(A)}(1) \qquad \textbf{(B)}(2) \qquad \textbf{(C)}(3) \qquad \textbf{(D)}(4) \qquad \textbf{(E)}(5)$

Problem 11

For a given value of k the product of the roots of $x^2-3kx+2k^2-1=0$ is 7. The roots may be characterized as:

$\textbf{(A) }\text{integral and positive} \qquad \textbf{(B) }\text{integral and negative}$
$\textbf{(C) }\text{rational, but not integral} \qquad \textbf{(D) }\text{irrational} \qquad \textbf{(E) }\text{imaginary}$

Problem 12

The locus of the centers of all circles of given radius a, in the same plane, passing through a fixed point, is:

$\textbf{(A)}\text{a point} \qquad \textbf{(B) }\text{ a straight line} \qquad \textbf{(C)}\text{two straight lines} \qquad \textbf{(D)}\text{a circle} \qquad \textbf{(E)}\text{two circles}$

Problem 13

The polygon(s) formed by $y=3x+2, y=-3x+2$, and $y=-2$, is (are):

$\textbf{(A) }\text{An equilateral triangle} \qquad \textbf{(B) }\text{an isosceles triangle} \qquad \textbf{(C) }\text{a right triangle}$
$\textbf{(D) }\text{a triangle and a trapezoid} \qquad \textbf{(E) }\text{a quadrilateral}$

Problem 14

If a and b are real numbers, the equation $3x - 5 + a = bx + 1$ has a unique solution x [The symbol $a \neq 0$ means that a is different from zero]:

(A) for all a and b (B) if a $\neq$ 2b (C) if a $\neq 6$
(D) if b $\neq 0$ (E) if b $\neq 3$

Problem 15

Triangle I is equilateral with side A, perimeter P, area K, and circumradius R (radius of the circumscribed circle). Triangle II is equilateral with side a, perimeter p, area k, and circumradius r. If A is different from a, then:

(A) $P:p = R:r$ only sometimes **(B)** $P:p = R:r$ always
(C) $P:p = K:k$ only sometimes **(D)** $R:r = K:k$ always **(E)** $R:r = K:k$ only sometimes

Problem 16

In the numeration system with base 5, counting is as follows: $1, 2, 3, 4, 10, 11, 12, 13, 14, 20, \ldots$. The number whose description in the decimal system is 69, when described in the base 5 system, is a number with:

(A) two consecutive digits **(B)** two non-consecutive digits
(C) three consecutive digits **(D)** three non-consecutive digits
(E) four digits

Problem 17

The formula $N = 8 \times 10^8 \times x^{-3/2}$ gives, for a certain group, the number of individuals whose income exceeds x dollars. The lowest income, in dollars, of the wealthiest 800 individuals is at least:

(A) 10^4 **(B)** 10^6 **(C)** 10^8 **(D)** 10^{12} **(E)** 10^{16}

Problem 18

The pair of equations $3^{x+y} = 81$ and $81^{x-y} = 3$ has:

(A) no common solution
(B) the solution $x = 2, y = 2$
(C) the solution $x = 2\frac{1}{2}, y = 1\frac{1}{2}$
(D) a common solution in positive and negative integers
(E) none of these

Problem 19

Consider equation $I: x + y + z = 46$ where x, y, and z are positive integers, and equation $II: x + y + z + w = 46$, where x, y, z, and w are positive integers. Then

(A) I can be solved in consecutive integers
(B) I can be solved in consecutive even integers
(C) II can be solved in consecutive integers
(D) II can be solved in consecutive even integers
(E) II can be solved in consecutive odd integers

Problem 20

The coefficient of x^7 in the expansion of $(\frac{x^2}{2}-\frac{2}{x})^8$ is:

$\textbf{(A)}\ 56 \qquad \textbf{(B)}\ -56 \qquad \textbf{(C)}\ 14 \qquad \textbf{(D)}\ -14 \qquad \textbf{(E)}\ 0$

Problem 21

The diagonal of square I is $a+b$. The perimeter of square II with twice the area of I is:

$\textbf{(A)}\ (a+b)^2 \qquad \textbf{(B)}\ \sqrt{2}(a+b)^2 \qquad \textbf{(C)}\ 2(a+b) \qquad \textbf{(D)}\ \sqrt{8}(a+b) \qquad \textbf{(E)}\ 4(a+b)$

Problem 22

The equality $(x+m)^2-(x+n)^2=(m-n)^2$, where m and n are unequal non-zero constants, is satisfied by $x=am+bn$, where:

$\textbf{(A)}\ a = 0, b \text{ has a unique non-zero value}$
$\textbf{(B)}\ a = 0, b \text{ has two non-zero values}$
$\textbf{(C)}\ b = 0, a \text{ has a unique non-zero value}$
$\textbf{(D)}\ b = 0, a \text{ has two non-zero values}$
$\textbf{(E)}\ a \text{ and } b \text{ each have a unique non-zero value}$

Problem 23

The radius R of a cylindrical box is 8 inches, the height H is 3 inches. The volume $V=\pi R^2H$ is to be increased by the same fixed positive amount when R is increased by x inches as when H is increased by x inches. This condition is satisfied by:

$\textbf{(A)}\ \text{A non-square, non-cube integer}$
$\textbf{(B)}\ \text{A non-square, non-cube, non-integral rational number}$
$\textbf{(C)}\ \text{An irrational number}$
$\textbf{(D)}\ \text{A perfect square}$
$\textbf{(E)}\ \text{A perfect cube}$

Problem 24

If $\log_{2x}216 = x$, where x is real, then x is:

$\textbf{(A)}\ \text{A non-square, non-cube integer} \qquad \textbf{(B)}\ \text{A non-square, non-cube, non-integral rational number}$

$\textbf{(C)}\ \text{An irrational number} \qquad \textbf{(D)}\ \text{A perfect square} \qquad \textbf{(E)}\ \text{A perfect cube}$

Problem 25

Let m and n be any two odd numbers, with n less than m. The largest integer which divides all possible numbers of the form $m^2-n^2$is:

$\textbf{(A)}\ 2 \qquad \textbf{(B)}\ 4 \qquad \textbf{(C)}\ 6 \qquad \textbf{(D)}\ 8 \qquad \textbf{(E)}\ 16$

Problem 26

Find the set of x-values satisfying the inequality $|\frac{5-x}{3}|<2$. [The symbol $|a|$ means $+a$ if a is positive, $-a$ if a is negative, 0 if a is zero. The notation $1<a<2$ means that a can have any value between 1 and 2, excluding 1 and 2.]

$\textbf{(A)}\ 1<x<11 \qquad \textbf{(B)}\ -1<x<11 \qquad \textbf{(C)}\ x<11 \qquad \textbf{(D)}\ x>11 \qquad \textbf{(E)}\ |x|<6$

Problem 27

Let S be the sum of the interior angles of a polygon P for which each interior angle is $7\frac{1}{2}$ times the exterior angle at the same vertex. Then

$\textbf{(A)}\ S=2660^{\circ}$ and P may be regular $\qquad \textbf{(B)}\ S=2660^{\circ}$ and P is not regular $\qquad \textbf{(C)}\ S=2700^{\circ}$ and P is regular $\qquad \textbf{(D)}\ 2700^{\circ}$ and P is not regular $\qquad \textbf{(E)}\ S=2700^{\circ}$ and P may or may not be regular

Problem 28

The equation $x-\frac{7}{x-3}=3-\frac{7}{x-3}$ has:

$\textbf{(A)}$ infinitely many integral roots $\qquad \textbf{(B)}$ no root $\qquad \textbf{(C)}$ one integral root

$\textbf{(D)}$ two equal integral roots $\qquad \textbf{(E)}$ two equal non-integral roots

Problem 29

Five times A's money added to B's money is more than $\$51.00$. Three times A's money minus B's money is $\$21.00$. If a represents A's money in dollars and b represents B's money in dollars, then:

$\textbf{(A)}\ a>9, b>6 \qquad \textbf{(B)}\ a>9, b<6 \qquad \textbf{(C)}\ a>9, b=6 \qquad \textbf{(D)}\ a>9$, but we can put no bounds on $b \qquad \textbf{(E)}\ 2a=3b$

Problem 30

Given the line $3x+5y=15$ and a point on this line equidistant from the coordinate axes. Such a point exists in:

$\textbf{(A)}$ none of the quadrants $\qquad \textbf{(B)}$ quadrant I only $\qquad \textbf{(C)}$ quadrants I, II only

$\textbf{(D)}$ quadrants I, II, III only $\qquad \textbf{(E)}$ each of the quadrants

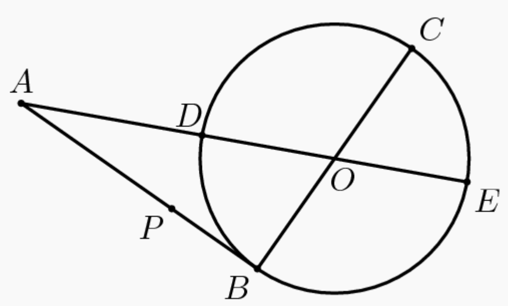
Problem 31

For x^2+2x+5 to be a factor of x^4+px^2+q, the values of p and q must be, respectively:

$\textbf{(A)}\ -2, 5 \qquad \textbf{(B)}\ 5, 25 \qquad \textbf{(C)}\ 10, 20 \qquad \textbf{(D)}\ 6, 25 \qquad \textbf{(E)}\ 14, 25$

Problem 32

In this figure the center of the circle is O. $AB\perp BC$, $ADOE$ is a straight line, $AP=AD$, and AB has a length twice the radius. Then:



$\textbf{(A)} AP^2=PB\times AB \qquad \textbf{(B)}\ AP\times DO=PB\times AD \qquad \textbf{(C)}\ AB^2=AD\times DE \qquad \textbf{(D)}\ AB\times AD=OB\times AO \qquad \textbf{(E)}$ none of

Problem 33

You are given a sequence of 58 terms; each term has the form $P+n$ where P stands for the product $2 \times 3 \times 5 \times \ldots \times 61$ of all prime numbers less than or equal to 61, and n takes, successively, the values $2, 3, 4, \ldots, 59$. Let N be the number of primes appearing in this sequence. Then N is:

$\textbf{(A)}\ 0 \qquad \textbf{(B)}\ 16 \qquad \textbf{(C)}\ 17 \qquad \textbf{(D)}\ 57 \qquad \textbf{(E)}\ 58$

Problem 34

Two swimmers, at opposite ends of a 90-foot pool, start to swim the length of the pool, one at the rate of 3 feet per second, the other at 2 feet per second. They swim back and forth for 12 minutes. Allowing no loss of times at the turns, find the number of times they pass each other.

$\textbf{(A)}\ 24 \qquad \textbf{(B)}\ 21 \qquad \textbf{(C)}\ 20 \qquad \textbf{(D)}\ 19 \qquad \textbf{(E)}\ 18$

Problem 35

From point P outside a circle, with a circumference of 10 units, a tangent is drawn. Also from P a secant is drawn dividing the circle into unequal arcs with lengths m and n. It is found that t_1, the length of the tangent, is the mean proportional between m and n. If m and $t$are integers, then t may have the following number of values:

$\textbf{(A)}\ \text{zero} \qquad \textbf{(B)}\ \text{one} \qquad \textbf{(C)}\ \text{two} \qquad \textbf{(D)}\ \text{three} \qquad \textbf{(E)}\ \text{infinitely many}$

Problem 36

Let s_1, s_2, s_3 be the respective sums of $n, 2n, 3n$ terms of the same arithmetic progression with a as the first term and d as the common difference. Let $R=s_3-s_2-s_1$. Then R is dependent on:

$\textbf{(A)}\ a\text{ and }d \qquad \textbf{(B)}\ d\text{ and }n \qquad \textbf{(C)}\ a\text{ and }n \qquad \textbf{(D)}\ a, d,\text{ and }n \qquad \textbf{(E)}\ \text{neither }a\text{ nor }d\text{ nor }n$

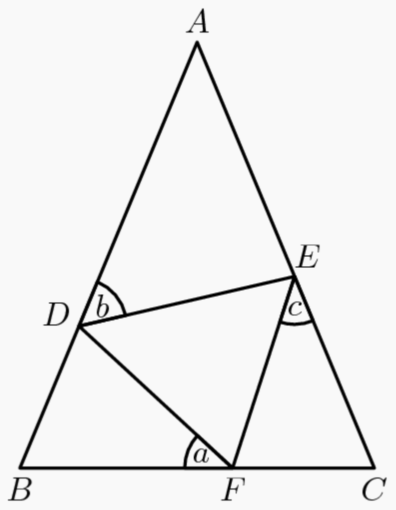
Problem 37

The base of a triangle is of length b, and the latitude is of length h. A rectangle of height x is inscribed in the triangle with the base of the rectangle in the base of the triangle. The area of the rectangle is:

$\textbf{(A)}\ \frac{bx}{h}(h-x) \qquad \textbf{(B)}\ \frac{hx}{b}(b-x) \qquad \textbf{(C)}\ \frac{bx}{h}(h-2x) \qquad \textbf{(D)}\ x(b-x) \qquad \textbf{(E)}\ x(h-x)$

Problem 38

In this diagram AB and AC are the equal sides of an isosceles $\triangle ABC$, in which is inscribed equilateral $\triangle DEF$. Designate $\angle BFD$ by a, $\angle ADE$ by b, and $\angle FEC$ by c. Then:



$\textbf{(A)}\ b=\frac{a+c}{2}\qquad\textbf{(B)}\ b=\frac{a-c}{2}\qquad\textbf{(C)}\ a=\frac{b-c}{2}\qquad\textbf{(D)}\ a=\frac{b+c}{2}\qquad\textbf{(E)}\ \text{none of these}$

Problem 39

To satisfy the equation $\frac{a+b}{a}=\frac{b}{a+b}$, a and b must be:

$\textbf{(A)}\ \text{both rational}\qquad\textbf{(B)}\ \text{both real but not rational}\qquad\textbf{(C)}\ \text{both not real}$

$\textbf{(D)}\ \text{one real, one not real}\qquad\textbf{(E)}\ \text{one real, one not real or both not real}$

Problem 40

Given right $\triangle ABC$ with legs $BC=3, AC=4$. Find the length of the shorter angle trisector from C to the hypotenuse: $\textbf{(A)}\ \frac{32\sqrt{3}-24}{13}\qquad\textbf{(B)}\ \frac{12\sqrt{3}-9}{13}\qquad\textbf{(C)}\ 6\sqrt{3}-8\qquad\textbf{(D)}\ \frac{5\sqrt{10}}{6}\qquad\textbf{(E)}\ \frac{25}{12}$