ALGEBRA I TEST, 1981   Edited by: John Kendall
                                                        Horace E. Williams

Scoring Formula: 4R - W + 40

        This test was prepared from a list of Algebra I questions submitted by
Shelby State Community College.

DIRECTIONS:

        Do not open this booklet until you are told to do so.

        This is a test of your competence in high school mathematics. For each problem
there are listed 5 possible answers; one and only one is correct. You are to work
each problem, determine the correct answer, and indicate your choice by making a
heavy black mark in the correct place on the separate answer sheet provided. You
must use a pencil with a soft lead (No. 2 lead or softer).

        This test has been constructed so that most of you are not expected to answer
all questions. Do your very best on the questions you feel you know how to work.
You will be penalized for incorrect answers, so it is advisable not to do much wild
guessing.

        If you should change your mind about an answer, be sure to erase completely.
Do not mark more than one answer for any problem. Make no stray marks of any kind
on your answer sheet. The answer sheets will not be returned to you. If you wish a
record of your performance, mark your answers in this booklet also. You will be able
to keep this booklet after the test is completed.

        When told to do so, open your test booklet to page 2 and begin. When you have
finished one page, go on to the next. The working time for the entire test is 80
minutes.

Contributors to TMTA for Annual Mathematics Contest:

1. $5x + 7 = 12$ has a solution of

    (a) 1

    (b) 5

    (c) $3\frac{4}{5}$

    d. -1

    (e) -5

2. $\dfrac{x^2 + 8x + 15}{x^2 - 25}$ when simplified to lowest terms is:

    (a) $\dfrac{x - 3}{x + 5}$

    (b) $\dfrac{x + 3}{x - 5}$

    (c) $\dfrac{3}{5}$

    (d) $\dfrac{x - 3}{x - 5}$

    (e) $-\dfrac{3}{5}$

3. The product of $(x - y)(x^2 + xy + y^2)$ is:

    (a) $x^3 - y^3$

    (b) $x^2 - y^2$

    (c) $x^3 + y^3$

    (d) $x^2 + y^2$

    (e) $x^3 + 2x^2y + 2xy^2 - y^3$

4. $\sqrt{98x^3yz^6}$ when simplified to lowest terms is:

    (a) $49x^2z^6 \sqrt{2xy}$

    (b) $7xz^3 \sqrt{2xy}$

    (c) $7xz^3 \sqrt{2xyz^3}$

    (d) $xz^3 \sqrt{98xyz}$

    (e) $14x^{\frac{1}{2}} yz^3$

5. The complete solution set of $3[7 - 6(y - 2)] = -3 + 2y$ is

    (a) $\frac{9}{10}$

    (b) $6\frac{3}{4}$

    (c) -15

    (d) $7\frac{1}{2}$

    (e) none of the above

6. The slope of the line whose equation is $5x + 9y = 10$ is:

    (a) $-\frac{9}{5}$

    (b) $\frac{5}{9}$

    (c) 5

    (d) -5

    (e) $-\frac{5}{9}$

7. $\dfrac{\sqrt{18} + \sqrt{50}}{\sqrt{8}}$ can be simplified to

    (a) 4

    (b) $4\sqrt{2}$

    (c) $\dfrac{\sqrt{68}}{\sqrt{8}}$

    (d) $\dfrac{\sqrt{68}}{2\sqrt{2}}$

    (e) $\dfrac{\sqrt{17}}{2}$

8. $x^5y^6 - x^4y^3 + x^3y^4$ when factored <u>completely</u> to lowest terms is:

    (a) $x^2y^3(x^3y^3 - x^2 + xy)$

    (b) $x^3(x^2y^6 - xy^3 + y^4)$

    (c) $y^3(x^5y^3 - x^4 + x^3y)$

    (d) $x^3y^3(x^2y^3 - x + y)$

    (e) $xy(x^4y^5 - x^3y^2 + x^2y^3)$

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9. The value for x in the equation $\frac{1.5}{x} = \frac{10}{.3}$ is

   (a) 45

   (b) 30

   (c) .045

   (d) 4.5

   (e) .45

10. Solve for <u>a</u> in the equation: $\frac{1}{a} = \frac{1}{b} - \frac{1}{c}$. When b = 8 and c = 11, the value is:

    (a) $\frac{3}{88}$

    (b) -3

    (c) $29\frac{1}{3}$

    (d) $-29\frac{1}{3}$

    (e) $-\frac{3}{88}$

11. The product of $(y^2 + 3y + 4)(y^2 - 3y + 4)$ when reduced is:

    (a) $y^4 + 6y^3 + 17y^2 + 24y + 16$

    (b) $2y^2 + 8$

    (c) $y^4 - 9y^2 + 16$

    (d) $y^4 - y^2 + 16$

    (e) $y^4 - 6y^3 + 17y^2 - 24y + 16$

12. If $x + 1 < 0$, then $|x + 1|$ equals:

    (a) $-x + 1$

    (b) $x - 1$

    (c) $x + 1$

    (d) x

    (e) $-x - 1$

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13. Assuming that $a \neq 0$, $b \neq 0$, and $c \neq 0$, the expression $\left(\dfrac{a^3 b^{-2} c^2}{a^{-3}}\right)^0$ when simplified is equal to

    (a) 1

    (b) 0

    (c) $\dfrac{b^2}{a^6 c^2}$

    (d) $\dfrac{a^6 c^2}{b^2}$

    (e) abc

14. Solve for S in the expression $V = \sqrt{2aS}$, $a \neq 0$, $S \neq 0$. The expression for S is

    (a) $S = \dfrac{V}{\sqrt{2a}}$

    (b) $S = \dfrac{V}{2a}$

    (c) $S = \dfrac{V^2}{\sqrt{2a}}$

    (d) $S = \dfrac{V^2}{2a}$

    (e) $S = 2aV$

15. $\dfrac{9x^2 y^3 z^{-1}}{12 x^3 y^{-3} z^2}$ when simplified to lowest terms is

    (a) $\dfrac{3}{4xz^3}$

    (b) $\dfrac{9y^6}{12xz^3}$

    (c) $\dfrac{3y^6}{4xz^3}$

    (d) $\dfrac{9x^5 z}{12}$

    (e) $\dfrac{9}{12xz^3}$

16. The length of a rectangle is 4 feet more than its width. If its area is 45 square feet, then the perimeter of the rectangle is

    (a) 18

    (b) 14

    (c) 26

    (d) 36

    (e) 28

17. $\dfrac{x^3 + 1}{x^3 + 3x^2 + 3x + 1}$ when simplified to lowest terms is:

    (a) $\dfrac{1}{3x^2 + 3x + 1}$

    (b) $\dfrac{x^2 - x + 1}{(x + 1)^2}$

    (c) $\dfrac{(x - 1)^2}{(x + 1)^2}$

    (d) 1

    (e) $3x(x + 1)$

18. $\dfrac{\sqrt{x} - \sqrt{5}}{\sqrt{x} + \sqrt{5}}$, when simplified, equals

    (a) 0

    (b) -1

    (c) $\dfrac{x - 5}{\sqrt{x^2 - 25}}$

    (d) $\sqrt{\dfrac{x - 5}{x + 5}}$

    (e) $\dfrac{x + 5 - 2\sqrt{5x}}{x - 5}$

19. The next term in the sequence 0, 3, 8, 15, 24 is

    (a) 27
    (b) 34
    (c) 35
    (d) 37
    (e) 64

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20. The complete solution set of $x^4 - 3x^2 - 4 = 0$ is

   (a) $\{2, -2\}$

   (b) $\{1, -1, 2, -2\}$

   (c) $\{2, -2, i\}$

   (d) $\{2, -2, i, -i\}$

   (e) none of the above

21. One <u>positive</u> number exceeds another by 6. If the larger number is divided by the smaller, the quotient is the same as when the smaller is divided by 25. The numbers are

   (a) -5, +1

   (b) 30, -5

   (c) 30, 36

   (d) 5, 11

   (e) none of the above

22. The complete solution set of the system of equations $\begin{cases} x^2 + y^2 = 25 \\ 3x - y = 5 \end{cases}$ is

   (a) (3, 4)

   (b) (0, -5) and (3, 4)

   (c) (0, -5)

   (d) (-5, 0) and (4, 3)

   (e) (0, -5) and (-3, -14)

23. The graph of $y = |x| + 1$ is
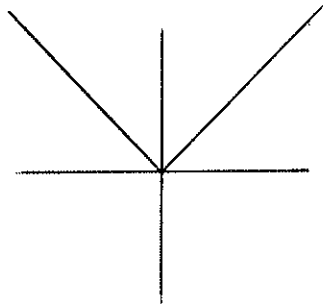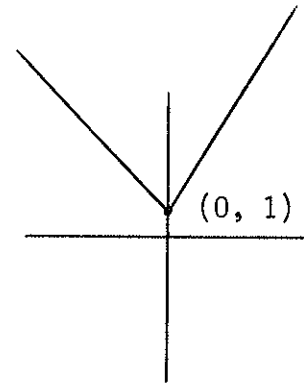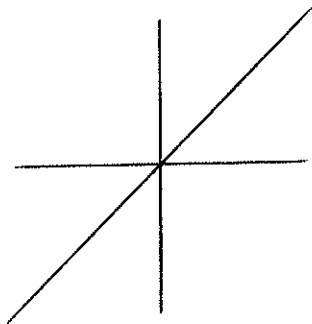
(a)

(0, 1)

(d)

(1, 0)

(b)

(e)

(0, 1)
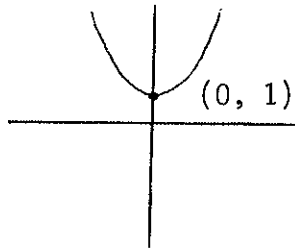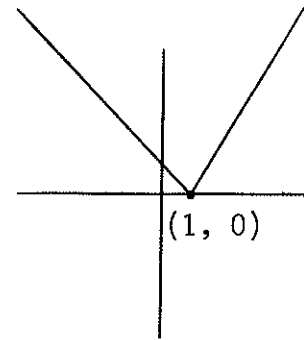
(c)

24. If k is a constant and one root of the equation $2x^2 - 5x + k = 0$ is 5, then three times the other root is

(a) -75

(b) 75

(c) $-7\frac{1}{2}$

(d) $7\frac{1}{2}$

(e) 3

25. Solve for y in $\frac{y-3}{4} = \frac{y+1}{6} - \frac{1}{2}$. The value of y is a multiple of

    (a) 2

    (b) 3

    (c) 4

    (d) 5

    (e) 7

26. Deborah has 29 coins in her purse that have a total value of $2.50. If these coins consist of nickels and dimes only, then twice the number of dimes minus the number of nickels equals

    (a) 82

    (b) 34

    (c) -22

    (d) -5

    (e) none of the above

27. $(a^{-1} + b^{-1})^{-1}$ can be simplified to

    (a) $a + b$

    (b) $\frac{1}{a+b}$

    (c) $\frac{ab}{a+b}$

    (d) $\frac{a+b}{ab}$

    (e) $\frac{1}{a^2 + b^2}$

28. Factor $x^6 - 1$ <u>completely</u> into prime factors in lowest terms.

    (a) $(x^3 + 1)(x^3 - 1)$

    (b) $(x + 1)^2(x^2 - x + 1)^2$

    (c) $(x - 1)^2(x^2 + x + 1)$

    (d) $(x + 1)^2(x^2 - x + 1)(x^2 + x + 1)$

    (e) $(x + 1)(x - 1)(x^2 - x + 1)(x^2 + x + 1)$

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29. The complete solution set for $3x^3 + 7x^2 = -3x$ is

    (a) $\left\{ \dfrac{-7 + \sqrt{13}}{6}, \dfrac{-7 - \sqrt{13}}{0} \right\}$

    (b) $\left\{ \dfrac{7 + \sqrt{13}}{6}, \dfrac{7 - \sqrt{13}}{6} \right\}$

    (c) $\left\{ 0, \dfrac{-7 + \sqrt{13}}{6}, \dfrac{7 - \sqrt{13}}{0} \right\}$

    (d) $\left\{ 0, \dfrac{-7 + \sqrt{13}}{6}, \dfrac{-7 - \sqrt{13}}{6} \right\}$

    (e) $\left\{ 0 \right\}$

30. The complete solution set for the equation: $\dfrac{1}{x^{-2}} - 16 = 48$ is

    (a) $\left\{ 4, -4 \right\}$

    (b) $\left\{ 8 \right\}$

    (c) $\left\{ +8, -8 \right\}$

    (d) $\emptyset$

    (e) $\left\{ 4\sqrt{2}, -4\sqrt{2} \right\}$

31. Let $A = \left\{ \{a\}, \{b\}, \{c\}, \emptyset \right\}$. Which of the following is false?

    (a) $\emptyset \subseteq A$

    (b) $\{a\} \in A$

    (c) $\{\emptyset\} \in A$

    (d) $\{b\} \in A$

    (e) A is a finite set.

32. A square is inscribed in a circle of radius 1. The length of a side of the square is

    (a) 2

    (b) 1

    (c) $\sqrt{2}$

    (d) π

    (e) $\dfrac{\sqrt{2}}{2}$

33. If $i = \sqrt{-1}$ then i^{49} is equal to

    (a) 1

    (b) i

    (c) -1

    (d) -i

    (e) 49i

34. Consider the general quadratic $ax^2 + bx + c = 0$, with a, b, and c integers. Which of the following is false?

    (a) The equation may have two irrational roots.

    (b) If $b^2 - 4ac < 0$, then the roots are complex.

    (c) The equation may have one rational and one irrational root.

    (d) If $b^2 - 4ac > 0$, one root may be positive and the other negative.

    (e) If $b^2 - 4ac = 0$, then the roots are equal.

35. The value of $\left(\dfrac{5^{-1} - 2^{-2}}{5^{-1} + 2^{-2}} \right)^{-1}$ when reduced and simplified is

    (a) $-\dfrac{1}{9}$

    (b) -9

    (c) 9

    (d) 0

    (e) undefined

36. The complete solution set of $x^2 + 6x - 16 \geqq 0$ is

    (a) $\{x \mid 2 \leq x \leq 8\}$

    (b) $\{x \mid x < -8\} \cup \{x \mid x \geq 2\}$

    (c) $\emptyset$

    (d) $\{x \mid x \leq -8\} \cup \{x \mid x \geq 2\}$

    (e) none of the above

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37. The equation of the line with x-intercept 3 and y-intercept 2 in slope intercept form is

    (a) $y = -\frac{3x}{2} + 3$

    (b) $y = \frac{2x}{3} + 2$

    (c) $y = \frac{3x}{2} + 3$

    (d) $2x + 3y + 6 = 0$

    (e) $y = -\frac{2x}{3} + 2$

38. Which one of the following linear equations has a graph perpendicular to the graph of $3x + 2y = 6$?

    (a) $-2x + 3y = 20$

    (b) $3x - 2y = 20$

    (c) $-3x - 2y = 20$

    (d) $-2x - 3y = 20$

    (e) none of the above

39. How high up the side of a house will a 15 foot ladder reach if the bottom is set 9 feet horizontally from the base of the house?

    (a) 15 ft.

    (b) 6 ft.

    (c) 24 ft.

    (d) 12 ft.

    (e) 10 ft.

40. A grower has two grades of coffee, one worth $2 a pound and the other worth $3 a pound. He wishes to make 100 pounds of a mixture worth $2.60 a pound. The number of pounds of $2 a pound coffee used in the mixture when divided by 10 is

    (a) 3

    (b) 4

    (c) 5

    (d) 6

    (e) The problem cannot be solved.