State Finals In Algebra II - May 6, 1999

1. Find the equation of a line perpendicular to $4x - 3y = 12$ that passes through point (2,3).

a) $y = 0.75x + 1.5$
b) $y = -0.75x + 4.5$
c) $y = -0.25x + 3.5$
d) $y = 1.33x - 4$
e) none of these

2. What is the area of the triangle whose sides le on the *x*-axis, the *y*-axis, and the perpendicular line obtained in the previous problem?

a) 1.5
b) 2.45
c) 12
d) 13.5
e) none of these

3. Given the line $4x - 3y = 12$, what is the distance between it and the origin?

a) 1.2
b) $\frac{7\sqrt{6}}{3}$
c) 2.4
d) 3.5
e) none of these

4. Which of the lines given below divides the following circle into two equal parts:

$$x^2 + 4x + y^2 + 6y = 10$$

a) $y = mx + 5$
b) $y = mx + 2m - 3$
c) $y = mx - 3m + 2$
d) $y = mx + 10$
e) none of these

5. Solve for *x*: $x(x - c) = 1 - c$

a) $x = 1, 1-c$
b) $x = 1, c$
c) $x = -1, c + 1$
d) $x = 1, c - 1$

e) none of these

6. For which value of c will the equation $x(x - c) = 1 - c$ have exactly one solution?

a) $c = 0$
b) $c = 1$
c) $c = 2$
d) $c = 0.5$
e) none of these

7. Given $x + 3y = a$ and $2x + 5y = b$, solve for x.

a) $x = -5a + 3b$
b) $x = 2a - b$
c) $x = 3a - 5b$
d) $x = 5a - 3b$
e) none of these

8. Find the values of m so that the difference between the roots of $3x^2 + mx - 12$ is 5.

a) 0
b) ± 4
c) ± 7
d) ± 9
e) none of these

9. Find the general expression of a quadractic function that passes through (0, 3) and (8,3).

a) $f(x) = ax^2 - 8x + 3$
b) $f(x) = a(x^2 - 8x) + 3$
c) $f(x) = a(x^2 - 8x + 3)$
d) $f(x) = x^2 - ax + 3$
e) none of these

10. Find the vertex of a quadratic function that has a for the x^2 coefficient and x-intercepts: (2, 0) and (10, 0).

a) $(6, -16a)$
b) $(6, a)$
c) $(a, 0)$
d) $(6/a, -16)$
e) none of these

11. For which value of b is there only one intersection between the line $y = x + b$ and the parabola $y = x^2 - 3x + 5$?

a) 0
b) 1
c) -2
d) 5
e) none of these

12. Let n be the number of intersections between a quadratic function and a cubic. What values can n have?

a) 1, 2, 3
b) 0, 1, 2, 3
c) 1, 2, 3, 4, 5
d) 0, 1, 2, 3, 4, 5
e) 1, 2, 3, 4, 5, 6

13. What is the maximum height a baseball will reach if its initial velocity $V_0 = 49$ m/s? Use the equation: $h(t) = V_0t - 4.9t^2$ where $h(t)$ represents the height of the ball in meters after t seconds.

a) 4.9 m
b) 12.5 m
c) 122.5 m
d) 490 m
e) none of these

14. Given: $f(t) = \dfrac{t-1}{t+1}$, evaluate $f^{-1}(\dfrac{1}{c}+1)$.

a) $1 / (1 + 2c)$
b) $1 / (2 + c)$
c) $2c - 1$
d) $c - 2$
e) none of these

15. Find the area enclosed by the graph of the following relation: $\dfrac{|x|}{5} - \dfrac{|y|}{3} = 1$.

a) 30
b) $\sqrt{34}$
c) 15
d) 60
e) none of these

16. Suppose a truck loaded with 400 computers weighs x lbs, and it weighs y lbs loaded with 300 of the same kind of computer. How much does the empty truck weigh?

a) $4y - 3x$
b) $4x - 3y$
c) $(4/3)(x - y)$
d) $(3/4)(x - y)$
e) none of these

17. Which value best approximates $\sqrt{6+\sqrt{6+\sqrt{6+\sqrt{6+\sqrt{\ldots}}}}}$?

a) 2.9974
b) 3
c) p
d) 6
e) infinity

18. Let $f(x) = 2^x$. For which exact value of x is $f(x - 2) = f(x) - 2$?

a) 8/3
b) 1.415
c) $\sqrt{2}$
d) $\log_2 3$
e) $3 - \log_2 3$

19. Solve for a: $\log_7(5a) - \log_7(a - 4) = 1$.

a) 0.75
b) 6
c) 9.75
d) 14
e) 24

20. Using the results from the previous problem, solve for b: $e^{2b} + 5e^b = a$.

a) 0
b) ln 3 - ln 2
c) ln 3
d) 1.2345
e) ln 2

21. Using the result from the previous problem, which answer below is the *x*-coordinate of an intersection between:

$$y = e^{bx} \text{ and } y = 2(x+1)^2$$

a) $\sqrt{0.5}-1$
b) 6.120394
c) 7
d) $\sqrt{5+\ln 7}$
e) curves don't intersect.

22. The height of a triangle is 6 units less than the length of its base. If the area of this triangle is 42 square units, how many units is the length of its base?

a) $\sqrt{93}+3$
b) $\sqrt{93}-3$
c) $\sqrt{60}$
d) 10
e) $\sqrt{42}-\sqrt{5}$

23. If five cards are drawn at random without replacement from a standard deck of 52 cards, what is the probability that exactly two aces will be drawn?

a) $\frac{2{,}162}{541{,}450}$ b) $\frac{2{,}162}{54{,}145}$ c) $\frac{23{,}782}{541{,}450}$
d) $\frac{10}{221}$ e) none of the above

24. Find the complete solution to the inequality: $x^3-8 \le 7x-14$

a) $x \le -3$ or $x \ge 1$ b) $-3 \le x \le 1$ c) $x \le -1$ or $2 \le x \le 3$
d) $-3 \le x \le 1$ or $x \ge 2$ e) $x \le -3$ or $1 \le x \le 2$

25. What value of *x* makes the following radical product equal to 13?

$$\sqrt{3\sqrt{x}-\sqrt{7x+\sqrt{4x-1}}}\cdot\sqrt{2x+\sqrt{4x-1}}\cdot\sqrt{3\sqrt{x}+\sqrt{7x+\sqrt{4x-1}}}$$

a) 1 b) $3+\sqrt{13}$ c) 7 d) $\sqrt{50}$
e) none of these.

26. Let $p(x) = x^7 - 3x^5 + x^3 - 7x^2 + 5$ and $q(x) = x - 2$. Find the remainder of $\frac{p(x)}{q(x)}$.

a) 5/2 b) 5 c) 17 d) -3 e) none of these

27. Given that z is a complex number and $i^2 = -1$. Solve for z given $2z + 1 = 2 - iz$

a) 0.6 - i b) 0.8 + 0.6i c) 0.8 - 0.6i d) 0.6 - 0.8i
e) none of these

28. If $f(x) = x^2 - c^2$, solve for x when $(f \circ f)(x) = 0$.

a) $x = \pm c$ b) $x = \pm\left(c + \sqrt{c}\right),\ x = \pm\left(c - \sqrt{c}\right)$
c) $x = \pm\sqrt{c^2 + c},\ x = \pm\sqrt{c^2 - c}$ d) $x = \pm c^2 + c,\ x = \pm c^2 - c$
e) none of the above

29. If $\log_7 3 = a$ and $\log_7 4 = b$, find x in terms of a and b if $9^x = 28$.

a) $x = \dfrac{1+b}{2a}$ b) $x = \dfrac{7b}{a^2}$ c) $x = \dfrac{b-a}{2}$

d) $x = \dfrac{2a}{b+1}$ e) none of the above

30. Given $x + x^2 + x^3 + x^4 + \ldots = 1.5$, find x.

a) 2/3 b) 3/5 c) 3/4 d) 5/6 e) none of these

31. Let $\otimes$ be an operation defined on functions such that:

$$f \otimes g(x) = f\left(g(x)\right) - g\left(f(x)\right).$$

If $f(x) = x^2 - 1$ and $g(x) = 2x + 1$, find $f \otimes g(x)$.

a) $x^2 - 2x - 2$ b) $2x^2 - 4x + 1$ c) $2x^2 + 4x - 2$

d) $2x^2 + 4x + 1$ e) none of the above.

32. Given the operation defined in problem 31, and the functions $p(t) = 5t - 2$ and $r(t) = at + b$, find the relation between a and b so that $p \otimes r(t) = 0$.

a) $a + 2b = 1$ b) $2a + 5b = 0$ c) $5a - 2b = 0$

d) $2a + 5b = 2$ e) can not be determined.

33. The distance from Charlotte to Asheville is about 120 miles. If R.C. has two hours to make the trip, but drives 50 mph for the first 60 miles, how fast must R.C. go on the second half of the trip to reach Asheville in time?

a) 70 mph b) 75 mph c) 77.2 mph

d) 80 mph e) none of these

34. Given $f(x) = x^3 + x - 5$, find t so that $f^{-1}(t) = 0.2$

a) -4.792 b) $-\sqrt[3]{4.8}$ c) 2 d) 1.5437
e) none of these

35. Given $x = V_0 t + 0.5at^2$ and $V_M = V_0 + x \cdot t^{-1}$ for $t > 0$, solve for t in terms of V_0 and V_M.

a) $t = \frac{1}{a}(V_M - V_0)$ b) $t = \frac{2}{a}(V_M - V_0)$ c) $t = \frac{2}{a}(V_M - 2V_0)$

d) $t = \frac{2}{a}V_M$ e) can not be determined

36. The local utility company charges customers a monthly connection fee and an amount proportional to the kilowatt hours used. If Decembers bill was \$80.36 for using 980 kwh, and January's bill was \$75.53 for using 910 kwh, how much does the company charge per kwh?

a) 7¢ b) 6.9¢ c) 8.2¢ d) 8.3¢ e) 8.25¢

37. Find the intersection of $y = 2^{(x+2)}$ and $y = 4^{(3x-4)}$.

a) (0,4) b) $(0.5, \sqrt{32})$ c) (1,8) d) (2,16) e) (3,32)

38. Find the center of the smaller circle that passes through the point located in problem 37 and that is tangent to both axes.

a) (4,4) b) (7,7) c) (10,10) d) (26,26)

e) $\left(35-8\sqrt{3}, 35-8\sqrt{3}\right)$

39. Find the point on line $y = 2x - 3$ which lies closest to (4,0).

a) (1.5,0) b) (2,1) c) 2.5,2) d) $\left(\sqrt{2}, \sqrt{8}-3\right)$ e) (3,3)

40. Find the area of the triangle whose vertices are the answers to problems 37, 38, and 39.

a) 25 b) 33.25 c) 30 d) 60 e) $784.2 - 134\sqrt{3}$

Answer Key:

1.	B	21.	C
2.	D	22.	A
3.	C	23	B
4.	B	24.	E
5.	D	25.	C
6.	C	26.	C
7.	A	27.	D
8.	D	28.	C
9.	B	29.	A
10.	A	30.	B
11.	B	31.	D
12.	A	32.	A
13.	C	33.	B
14.	E	34.	A
15.	A	35.	C
16.	A	36.	B
17.	B	37.	D
18.	E	38.	C
19.	D	39.	B
20.	E	40.	D