Please print the following information:

Name: ____________________________  Instructor: ____________________________

Student ID #: ______________________  Section/Time: __________________________

This exam Consists of 40 multiple choice questions. Read all questions carefully. You may do calculations on the test paper and you may use your graphing calculator. Mark the number of the opscan sheet corresponding to the test question number with a Number 2 pencil or a mechanical pencil with HB lead. Mark only one answer; otherwise the answer will be counted as incorrect. You are not penalized for guessing. Please make sure that your name appears on the opscan sheet in the spaces provided.

At the end of the examination, you MUST hand in this test booklet, your answer sheet and all scratch paper.

Formulae:

Factoring: \(x^3 - a^3 = (x - a)(x^2 + xa + a^2)\)
\(x^3 + a^3 = (x + a)(x^2 - xa + a^2)\)

Quadratic Formula: \(\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\)

Lines: \(y - y_0 = m(x - x_0); \ y = mx + b\)

Distance: \(d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\)

Mid Point: \(\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)\)

Circle: \((x - h)^2 + (y - k)^2 = r^2\)

Parabola: \(y = a(x - h)^2 + k\)

Difference Quotient: \(\frac{f(x + h) - f(x)}{h}\)

Compound Interest: \(A = P(1 + \frac{r}{n})^{nt}\)

Continuous Interest: \(A = Pe^{rt}\)

Logarithms:
\(\log_b(xy) = \log_b(x) + \log_b(y)\)
\(\log_b(x^p) = p \log_b(x)\)
\(\log_b\left(\frac{x}{y}\right) = \log_b(x) - \log_b(y)\)
1. Complete the multiplication \((2x + 3)(x^2 - 2)\).

(a) \(2x^3 + 3x^2 - 4x - 6\)
(b) \(2x^3 - 6\)
(c) \(x^2 + 2x + 1\)
(d) \(2x^3 + x^2 - 4x - 6\)
(e) none of these

2. Solve the inequality \(|x + 1| > 3\):

(a) \((2, \infty)\)
(b) \((-\infty, -4) \cup (2, \infty)\)
(c) \((-\infty, -4] \cup [2, \infty)\)
(d) \((-4, 2)\)
(e) \([-4, 2]\)

3. The stopping distance \(d\) of an automobile is directly proportional to the square of its speed \(v\). A car required 30 feet to stop when its speed was 40 miles per hour. Find its stopping distance (in feet) when its speed \(v\) is 60 miles per hour.

(a) 55 feet
(b) 60 feet
(c) 62.5 feet
(d) 67.5 feet
(e) 75 feet

4. If \(\frac{1}{2}a - 2(a + 1) = a\) and \(b + \frac{1}{3}(b - 1) = 1\), find \(a + b\):

(a) \(-1\)
(b) 0
(c) \(\frac{1}{5}\)
(d) \(\frac{3}{5}\)
(e) None of these
5. Simplify the expression \( \left( \frac{a^{-2}}{2bc^{-3}} \right)^{-2} \)

(a) \( \frac{2ba^4}{c^6} \)
(b) \( \frac{4a^4b^2}{c^6} \)
(c) \( \frac{c^3}{a^2b} \)
(d) \( \frac{c^6}{4a^4b^2} \)
(e) None of these

6. Find the domain of the function \( f(x) = \sqrt{9 - x^2} \).

(a) \( x \geq 3 \)
(b) \( x \leq 3 \)
(c) \( -3 \leq x \leq 3 \)
(d) \( x \geq -3 \)
(e) All real numbers

7. Which of the following functions is an odd function?

(a) \( f(x) = x^2 + 1 \)
(b) \( f(x) = 3x^3 - 2x + 5 \)
(c) \( f(x) = x^3 - 1 \)
(d) \( f(x) = 4x^5 - 2x^3 + x \)
(e) \( f(x) = 5x^4 - 3x^2 + 1 \)

8. Perform the indicated operation and simplify: \( \frac{2}{x+2} - \frac{x}{x-2} \).

(a) \( \frac{-x^2 + 2x}{x^2 - 4} \)
(b) \( \frac{-x^2 - 4}{x^2 - 4} \)
(c) \( \frac{2 - x}{4} \)
(d) \( \frac{2 - x}{2x} \)
(e) \( \frac{x^2 - 8}{x^2 - 4} \)
9. The graph of the function \( y = (x - 2)^3 - 3 \) can be obtained from the graph of the function \( y = x^3 \) by which of the following transformations?

(a) Shift to the right by 3 units, then shift down by 2 units;
(b) Shift to the left by 4 units, reflect around the \( y \)-axis, then shift up by 2 units;
(c) Shift to the right by 2 units, then shift down by 3 units;
(d) Shift to the left by 2 units, then shift down by 3 units;
(e) none of the above.

10. Use the Rational Zero Test to determine which of the following numbers is definitely not a zero of the polynomial \( 3x^4 + 3x^3 + ax^2 + bx - 12 \) (where \( a \) and \( b \) are some integers)?

(a) \(-1\)
(b) \(\frac{2}{3}\)
(c) \(-\frac{4}{3}\)
(d) 12
(e) \(\frac{3}{2}\)

11. A leather jacket was on sale at a department store at 40% off its regular price. The store manager later decided to give it an additional 30% off after the first 40% price cut. The final price of the deeply discounted jacket is now $147, what was its original price?

(a) $310
(b) $330
(c) $350
(d) $380
(e) $400

12. Given that \((0, 1)\) is the center of a circle and \((-4, 4)\) is a point on the circle, find the radius of the circle:

(a) 1
(b) \(2\sqrt{2}\)
(c) 5
(d) 10
(e) none of these
13. Solve the equation \( e^{2x+b} = 23 \) for \( x \):

(a) \( \frac{(\ln(2) - b)}{23} \)
(b) \( \frac{(\log_{23}(e) - b)}{2} \)
(c) \( \frac{e^{2^2} - b}{2} \)
(d) \( \frac{(\ln(25) + b)}{2} \)
(e) \( \frac{(\ln(23) - b)}{2} \)

14. Given that \((1, -5)\) and \((3, 7)\) form a pair of diameter points on a circle, find the center of the circle.

(a) \((2, 1)\)
(b) \((1, 6)\)
(c) \((1, 1)\)
(d) \((-1, -6)\)
(e) \((4, 2)\)

15. Given \( f(x) = \sqrt{x^2 + x + 1} \) and \( g(x) = x^2 - 1 \), find \((g \circ f)(x)\).

(a) \( y = \sqrt{(x^2 - 1)^2 + (x^2 - 1) + 1} \)
(b) \( y = (x^2 + x + 1)x - 1 \)
(c) \( y = x^2 + x \)
(d) \( y = \sqrt{x^2 + x + 1}x^2 - 1 \)
(e) none of these

16. Given \( f(x) = \begin{cases} \frac{-x^3 + 2x + 1}{x^2 + 5} & \text{if } x < 1 \\ x^2 & \text{if } x \geq 1 \end{cases} \), find \( f(-1) + f(1) + f(2) \).

(a) 11
(b) 15
(c) 17
(d) 19
(e) none of these
17. Given \( f(x) = 3x - 9 \), find \( f^{-1}(x) \).
(a) \( \frac{1}{3}x + 3 \)
(b) \( -\frac{1}{3}x + 3 \)
(c) \( \frac{1}{3}x + 9 \)
(d) \( 3x + 9 \)
(e) does not exist

18. If \( a \) and \( b \) are positive numbers such that \( a^{3/2} = 8 \) and \( b^{2/3} = 4 \), find \( b - a \):
(a) 0
(b) 2
(c) 4
(d) 6
(e) 8

19. The equation of a circle is \( x^2 + 6x + y^2 - 2y = 6 \), find its radius.
(a) 1
(b) 2
(c) 3
(d) 4
(e) 5

20. Find the vertex of the quadratic function \( f(x) = 2x^2 - 16x + 25 \).
(a) (4, -7)
(b) (-4, 7)
(c) (-4, 121)
(d) (0, 25)
(e) none of these

21. Determine which interval given below is the solution set of the inequality \( (2x - 1)^2 \leq 9 \).
(a) \([-1, 1]\)
(b) \((-1, 2]\)
(c) \((-\infty, -1] \cup [2, \infty)\)
(d) \((-\infty, -1) \cup (2, \infty)\)
(e) \([-1, 2]\)
22. Solve the inequality \( \frac{3}{x-1} \leq -2 \) and express your answer in interval notation:

(a) \((-\infty, -1/2)\)
(b) \((-1/2, \infty)\)
(c) \([-1/2, \infty)\)
(d) \([-1/2, 1)\)
(e) \((-\infty, -1/2] \cup (1, \infty)\)

23. Which of the following \textbf{BEST} describes the solution(s) of the equation \(3x^2 - 11x + 7 = 0\)?

(a) There are two solutions and both are positive.
(b) There are two solutions, one is positive and the other is negative.
(c) There is only one solution and it is positive.
(d) There is only one solution and it is negative.
(e) There are no real solutions to the equation.

24. Find the \textbf{horizontal asymptote}, if any, of the function \(f(x) = \frac{x^2 - 3x + 2}{2x^2 - 32}\).

(a) \(y = \frac{1}{2}\)
(b) \(y = \pm 4\)
(c) \(y = 1, y = 2, \text{ and } y = \pm 4\)
(d) \(y = -\frac{1}{16}\)
(e) No horizontal asymptote

25. The vertex of a quadratic function is \((2, -1)\) and its \(y\)-intercept is 7. Find the function.

(a) \(y = (x + 1)^2 - 2\)
(b) \(y = \frac{3}{2}(x - 2)^2 + 1\)
(c) \(y = 2(x + 2)^2 - 1\)
(d) \(y = \frac{3}{2}(x + 2)^2 + 1\)
(e) \(y = 2(x - 2)^2 - 1\)
26. Which of the following is a factor of the polynomial $6x^2 + 11x - 10$?

(a) $2x - 5$
(b) $3x - 5$
(c) $6x - 1$
(d) $3x - 2$
(e) $6x - 5$

27. Combine $2 \log(4x) + 3 \log y - 4 \log z$ into a single logarithm term:

(a) $\log \left( \frac{8x + 3y}{4z} \right)$
(b) $\log \left( \frac{8x^2y^3}{z^4} \right)$
(c) $\log (8x + 3y - 4z)$
(d) $\log (16x^2 + y^3 - z^4)$
(e) $\log \left( \frac{16x^2y^3}{z^4} \right)$

28. Solve the equation $3x^2 - 7x + 3 = 0$ using the quadratic formula:

(a) $\{ \frac{10}{3}, -1 \}$
(b) $\{ \frac{7 + \sqrt{13}}{6}, \frac{7 - \sqrt{13}}{6} \}$
(c) $\{ \frac{-7 + \sqrt{13}}{6}, \frac{-7 - \sqrt{13}}{6} \}$
(d) $\{ \frac{7 + \sqrt{85}}{6}, \frac{7 - \sqrt{85}}{6} \}$
(e) no real solution

29. Find the slope of the line that goes through the points $(-3, 5)$ and $(-5, 9)$.

(a) 2
(b) 1
(c) 0
(d) $-1$
(e) $-2$
30. Find the range of the function \( f(x) = -2e^{x-3} + 4 \).

(a) \((-∞, 4]\)
(b) \([4, ∞)\)
(c) \((4, ∞)\)
(d) \((-∞, 4)\)
(e) \([3, 4]\)

31. Solve the equation \( 3^{2x+1} = 9^{-x+2} \)

(a) \(-1\)
(b) \(0\)
(c) \(1/4\)
(d) \(1/3\)
(e) \(3/4\)

32. The polynomial \( f(x) = 3x^{99} - 2x^{25} + 5x + 1 \) is divided by \( x + 1 \). Use the remainder theorem to find the remainder.

(a) \(-5\)
(b) \(-3\)
(c) \(1\)
(d) \(5\)
(e) \(7\)

33. If \( f(x) \) is an even function and \( f(-2) = -3 \), then which of the following must be true?

(a) \( f(-3) = 2\)
(b) \( f(2) = -3\)
(c) \( f(2) = 3\)
(d) \( f(3) = -2\)
(e) \( f(-3) = -2\)
34. Find the quotient of \( \frac{3x^3 + x^2 - 5x + 1}{x - 1} \) by either the synthetic division or the long division.

(a) \( 3x^2 + 4x - 1 \)
(b) \( 3x^3 + 4x^2 - x \)
(c) \( 3x^2 - 2x - 3 \)
(d) \( 3x^2 - 2x + 3 \)
(e) none of these

35. Given \( f(x) = x - 2 \) and \( g(x) = x^2 + 2x - 15 \), find the domain of \( \frac{f(x)}{g(x)} \).

(a) \( x > 2 \)
(b) \( x \neq -5, \ 3 \)
(c) \( x \neq -5, \ 2, \ 3 \)
(d) all real numbers
(e) none of these

36. \( \log_5(13) \) is the solution to which of the following equations?

(a) \( 5x = 13 \)
(b) \( 13^x = 5 \)
(c) \( x^5 = 13 \)
(d) \( 5^x = 13 \)
(e) \( 13^x = 5 \)

37. Solve the equation \( \log_5(2x + 1) = 2 \).

(a) \( x = 4.5 \)
(b) \( x = 12 \)
(c) \( x = 14.5 \)
(d) \( x = 13 \)
(e) none of these
38. Carl opened a savings account with an initial deposit of $10,000. The account has a fixed APR of 4.5% and the interest is compounded monthly. If Carl makes no further deposit, what will be the account’s accumulated value after 5 years (round off to the nearest cent)?

(a) $12,461.82
(b) $12,507.51
(c) $12,517.96
(d) $12,523.23
(e) $122,266.94

39. If \( x \) and \( y \) are the solutions to the system of equations \[
\begin{align*}
    x - y &= 3 \\
    3x + y &= 5
\end{align*}
\] find the value of \( x^2 + y^2 \):

(a) 1
(b) 2
(c) 3
(d) 4
(e) 5

40. A line passes through the point \((-3, 4)\) and is perpendicular to the line whose equation is \( y = -\frac{3}{2}x + 5 \), its equation is:

(a) \( y = \frac{2}{3}x + 5 \)
(b) \( y = -\frac{2}{3}x + 2 \)
(c) \( y = \frac{3}{2}x + \frac{17}{2} \)
(d) \( y = \frac{2}{3}x + 6 \)
(e) none of these

End of Exam