

MATH 1100

Common Final Exam

Spring 2016
May 5, 2016

Please print the following information in case your scan sheet is misplaced:

Name: _____ Instructor: _____

Student ID: _____ Section/Time: _____

The exam consists of 40 multiple choice questions, each of equal value. You may do calculations on this question booklet paper but not on the opscan sheet. Mark beside the number of the opscan sheet corresponding to the test question number in pencil only. Mark only one answer; otherwise the answer will be counted as incorrect. You are not penalized for guessing. Please make sure that your name and student ID appear on the opscan sheet in the spaces provided.

Questions begin on page 1 and be sure to check the back of each page for questions.

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

You may use the following formulae:

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

Circle: $(x - h)^2 + (y - k)^2 = r^2$ **Lines:** $y - y_0 = m(x - x_0); y = mx + b$

Quadratic formula: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ **Parabola Vertex:** $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right), a \neq 0$

Difference quotient: $\frac{f(x + h) - f(x)}{h}$ **Average rate of change on $[a, b]$:** $\frac{f(b) - f(a)}{b - a}$

Compound Interest: $A = P\left(1 + \frac{r}{n}\right)^{nt}$ **Continuous Interest:** $A = Pe^{rt}$

Exponential Growth: $A(t) = A_0e^{rt}, r > 0$ **Exponential Decay:** $A(t) = A_0e^{-rt}, r > 0$

Logarithms:

$\log_b(xy) = \log_b(x) + \log_b(y)$

$\log_b(x^p) = p \log_b(x)$

$\log_b b^a = a = b^{\log_b a}$

$\ln(x) = \log_e(x)$

$\log_b\left(\frac{x}{y}\right) = \log_b(x) - \log_b(y)$

$\log_b(x) = \frac{\ln x}{\ln b} = \frac{\log_{10} x}{\log_{10} b}$

$\ln e^a = a = e^{\ln a}$

- Which of the following is a factor of $5x^2 - 17x + 6$
(a) $x - 17$ (b) $x - 3$ (c) $5x + 2$ (d) $5x - 3$ (e) $5x - 6$
- Simplify the expression $\frac{x^2(xy)^{-3}z^{-2}}{x^{-2}yz^{-1}}$ and express your answer without any negative exponents.
(a) $\frac{x}{y^4z}$ (b) $\frac{x^5}{y}$ (c) x^5y^2 (d) $x^{15}y^2$ (e) $\frac{1}{y}$
- Simplify the radicals and combine like terms in $\sqrt{75} - \sqrt{\frac{3}{4}}$.
(a) $5.1\sqrt{2}$ (b) $\sqrt{\frac{72}{4}}$ (c) $4.5\sqrt{3}$ (d) $\sqrt{\frac{297}{4}}$ (e) $24\sqrt{3}$
- Solve the equation $x^2 - 8x = 9$ and calculate the sum of the solutions
(a) $2\sqrt{\frac{9}{8}}$ (b) 4 (c) -8 (d) 8 (e) -9
- We are given that $f(x)$ is an odd function and $g(x)$ is an even function. Also $f(3) = 6$ and $g(3) = 11$. What is the value of $f(-3) + g(-3)$?
(a) 17 (b) -5 (c) 5 (d) -3 (e) not enough information to say
- Emily invests in a bank paying 5% (simple) interest. Her sister Charlotte invests \$500 more than Emily in an account paying 7% interest. Their combined interest at the end of the year was \$311. How much did Emily invest?
(a) 3000 (b) 2300 (c) 1800 (d) 1300 (e) 3200
- Quantity y varies inversely with the square of x . y has value 6 when $x = 3$. When $x = 6$, what is the corresponding value of y ?
(a) $\frac{15}{9}$ (b) 3 (c) $\frac{3}{2}$ (d) $\frac{45}{36}$ (e) 15
- Solve the equation $x + 3 = \sqrt{30x + 34}$. Which statement describes the solution set best?
(a) One solution, it is negative. (b) There are positive and negative solutions.
(c) Two positive solutions. (d) One solution, it is positive. (e) There is no solution.

9. What is the equation of the line passing through the center of the circle $(x - 3)^2 + (y + 2)^2 = 12$ and having x -intercept $(2, 0)$.
- (a) $(x - 2)^2 + (y - 4)^2 = 20$ (b) $y = \sqrt{12}x - 2$ (c) $y = \frac{1}{2}x - 2$
(d) $y = -2x + 4$ (e) $(x - 3)^2 + (y - 12)^2 = 144$
10. What is the radius of the circle whose equation is $x^2 - 4x + y^2 + 14y - 11 = 0$?
- (a) 8 (b) $\frac{\sqrt{30}}{2}$ (c) $\frac{14}{2}$ (d) $\sqrt{11}$ (e) $\sqrt{8}$
11. Solve the inequality $-\frac{1}{2} + x < 3x - 2 \leq \frac{5}{2} + x$
- (a) $(-\infty, -2)$ (b) $(-1, 5]$ (c) $\left[\frac{3}{4}, \frac{9}{4}\right]$ (d) $\left(\frac{1}{3}, \frac{5}{2}\right]$ (e) $\left(\frac{1}{2}, \frac{3}{2}\right]$
12. What is the equation of the line through the points $(4, -11)$ and $(3, 16)$?
- (a) $y = -\frac{1}{27}x + 20$ (b) $y = \frac{27}{7}x + \frac{5}{2}$ (c) $y = 27x + 11$
(d) $y = -27x + 16$ (e) $y = -27x + 97$
13. Find the equation of the line perpendicular to the line given by $3x + 2y + 8 = 0$ which has the same y -intercept.
- (a) $y = \frac{2}{3}x - 4$ (b) $y = -3x - 8$ (c) $y = -\frac{3}{2}x + \frac{8}{3}$ (d) $y = \frac{1}{3}x + 8$ (e) $y = \frac{1}{2}x + \frac{2}{3}$
14. Let $f = \{(-3, 0), (-2, 1), (-1, 2), (0, 3), (2, 4), (3, 3), (4, 2)\}$, also let $g = \{(-3, 2.5), (-2, 2), (0, 1.5), (2, 1), (3, -1), (4, -3)\}$. Determine if both f and g are functions, and if they are, then evaluate the quantity $(f + g)(2) + f \circ g(3)$
- (a) -1 (b) 5 (c) 7 (d) 3 (e) one of f, g is not a function
15. For the function $f(x) = \begin{cases} x + 15, & -4 \leq x \leq 0 \\ 10 - x^2, & 0 < x \leq 5 \end{cases}$ calculate the value of $f(-4) + f(0) + f(5)$.
- (a) 11 (b) -1 (c) 15 (d) -11 (e) 46
16. Find the formula for $f^{-1}(x)$ for the function $f(x) = \frac{3x}{2x + 1}$
- (a) $\frac{x}{3 - 2x}$ (b) $\frac{2x + 1}{3x}$ (c) $-\frac{3x}{2x - 1}$ (d) $\frac{3x - 1}{2x + 3}$ (e) $\frac{x + 1}{x - 3}$

17. Determine the domain of $f(x) = \frac{\sqrt{3-x}}{x+2}$
- (a) $x \neq -2, 3$ (b) $(-\infty, -2) \cup (-2, \infty)$ (c) $(-\infty, -2) \cup (-2, 3]$
 (d) $3 \leq x, x \neq -2$ (e) $x \geq -2$
18. Divide and reduce to lowest terms $\frac{x-3}{x^2-25} \div \frac{x+2}{x^2-3x-10}$
- (a) $\frac{(x-3)^2}{(x+2)(x-5)}$ (b) $\frac{(x-3)(x+5)}{(x-5)(x+2)}$ (c) $\frac{x+2}{x-5}$ (d) $\frac{x-3}{x+5}$ (e) $\frac{x-4}{x-3}$
19. Add the rational expressions $\frac{x+2}{x+1} + \frac{4}{x^2+4x+3} - 1$
- (a) $\frac{x+5}{x^2+4x}$ (b) $\frac{-x+1}{(x+3)(x+1)}$ (c) $\frac{x^3+4x^2+4x-1}{x^2+4x+3}$ (d) $\frac{x+7}{(x+3)(x+1)}$ (e) $\frac{x+5}{x^2+5x+4}$
20. Simplify the difference quotient for $f(x) = x^2 - 2x$
- (a) $\frac{x^2 - 2x}{h}$ (b) $2x - 2$ (c) $\left(\frac{x}{h}\right)$ (d) $2x - 2 + h$ (e) $h - 2$
21. Solve the inequality $|5x - 2| + 6 \leq 13$
- (a) $\left[-1, \frac{9}{5}\right]$ (b) $(-\infty, -13)$ (c) $(-\infty, 7]$ (d) $\left[-\frac{9}{5}, \frac{9}{5}\right]$ (e) $[-7, 7]$
22. Find the equation of the parabola with vertex $(-2, -3)$ that passing through the origin.
- (a) $y = \frac{2}{9}(x+3)^2 - 2$ (b) $y = \frac{3}{4}(x+2)^2 - 3$ (c) $y = -2x^2 + 3x$
 (d) $y = -\frac{3}{4}(x-2)^2 + 3$ (e) $y = (x+2)^2 - 3$
23. The profit per unit, $P(x)$, when manufacturing x units is given by the formula
- $$P(x) = -20x^2 + 200x - .0015$$
- What is the maximum possible profit per unit?
- (a) \$499.9985 (b) \$200 (c) \$500.015 (d) \$5 (e) \$500

24. Describe the transform steps to obtain the graph of $g(x) = \sqrt{-x-5} + 3$ from the graph of $f(x) = \sqrt{x}$
- (a) shift right by 5, reflect around x -axis, then up by 3
 - (b) shift left by 5, reflect around y -axis, then up by 3
 - (c) shift left by 5, reflect around x -axis, then down by 3
 - (d) shift up by 3, reflect around y -axis, then right by 5
 - (e) shift right by 5, reflect around y -axis, then up by 3

25. The graph of the function $g(x)$ has been obtained from the graph of $f(x) = \sqrt[3]{x}$ by the following transform steps: shifted left by 4, reflected around the x -axis, vertically stretched by a factor of 2, then down by 8.

What is the value of $g(-12)$?

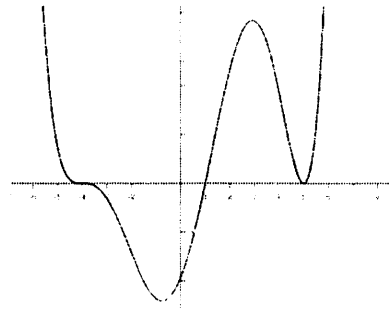
- (a) -12 (b) 4 (c) -7 (d) -4 (e) 0
26. According to the rational zeroes theorem, which of the numbers listed below would you NOT need to check if it is a rational solution of the following equation?

$$14x^4 + 18x^3 - 401x^2 + 15x - 33 = 0$$

- (a) $-\frac{11}{2}$ (b) $\frac{1}{14}$ (c) $-\frac{11}{7}$ (d) 14 (e) $-\frac{3}{14}$
27. State the degree and the end-behavior for $P(x) = -7(x+5)^2x^3(x-8)(x^2+5)$
- (a) degree 7, Up/Down (b) degree 8, Down/Down (c) degree 6, Down/Down
 - (d) degree 8, Up/Up (e) degree -7, Down/Up

28. Identify the Vertical Asymptotes of the graph of $f(x) = \frac{3x+6}{(x+3)(5x-1)(x+2)}$
- (a) $x = -3, -2, \frac{1}{5}$ (b) $x = -10, -5, 2$ (c) $x = 3, \pm\sqrt{8}/2$
 - (d) $x = -3, -\frac{1}{5}, 2$ (e) $x = \frac{1}{5}, -3$

29. Pick the polynomial which best matches this graph based on end-behavior and the behavior of x -intercepts



- (a) $(x + 4)^2(x - 1)^2(x - 5)$ (b) $-(x + 4)^3(x - 1)(x - 5)^2$
 (c) $(x + 4)^3(x - 1)(x - 5)^2$ (d) $(x + 4)^2(x - 1)(x - 5)^3$
 (e) $(x + 4)(x - 1)(x - 5)^2$
30. Identify the Horizontal Asymptote (if any) of the function $f(x) = \frac{7 - 4x + 3x^3}{3x + 4x^3}$
- (a) $y = 0$ (b) $y = \frac{1}{3}x + 9$ (c) $y = -\frac{4}{3}$ (d) $y = \frac{3}{4}$ (e) none
31. Solve the inequality $\frac{x + 3}{2x - 5} \leq 0$.
- (a) $(-\frac{5}{2}, 3]$ (b) $[-3, \infty)$ (c) $(-\infty, -3) \cup (\frac{5}{2}, \infty)$ (d) $[-3, \frac{5}{2})$ (e) $(-\infty, -3] \cup (\frac{5}{2}, \infty)$
32. Solve the inequality $x^2 > 3x + 28$
- (a) $(-\frac{\sqrt{28}}{3}, \infty)$ (b) $[-4, 7]$ (c) $(-\infty, -4) \cup (7, \infty)$ (d) $(-\infty, -\frac{\sqrt{28}}{3}) \cup [1, \infty)$ (e) $(-\frac{28}{3}, \infty)$
33. Solve for x in the equation $8^{3x} = 4^{5x-2}$
- (a) $(\log_4 8)^3$ (b) $\frac{3}{5}$ (c) $\frac{1}{2}$ (d) 4 (e) $\frac{5}{3} - 2$
34. Combine the expression $2 \log_b(3) + 2 \log_b(5 + x) - \frac{1}{2} \log_b(9)$ into a single log
- (a) $\log_b(30x^2 - \frac{9}{2})$ (b) $\log_b(3(x + 5)^2)$ (c) $\log_b\left(\frac{60x}{4.5}\right)$
 (d) $\log_b\left(\frac{16+x}{3}\right)$ (e) $\log_b\left((4 - \frac{1}{2})(5 + x)\right)$
35. Solve the equation $\log(x + 8) + \log(x) = \log(x + 18)$ and choose the correct statement:
- (a) there is one solution and it is positive (b) there are two positive solutions
 (c) there is a positive and a negative solution (d) there are no solutions
 (e) there are two negative solutions

36. Solve to the nearest 3 decimal places: $17 = 25 \cdot 3^{0.04x} - 5$. The solution will lie in which interval:

- (a) $(-\infty, -1)$ (b) $(-1, 1)$ (c) $(1, 2.65)$ (d) $(2.3, 5.6)$ (e) $(5.6, \infty)$

37. How much money is in the account 12 years after investing \$1500 at 4% compounded monthly? (round to nearest dollar)

- (a) \$2530 (b) \$1760 (c) \$12027 (d) \$2401 (e) \$2422

38. Interest is compounded continuously at 3%. How long will it take for a \$7500 investment to grow to \$12000?

- (a) less than 10 years (b) 10-15 years (c) 15-20 years
(d) 20-25 years (e) more than 25 years

39. If x and y satisfy the system of equations

$$x + 2y = 0$$

$$x - y = -6$$

Then x is equal to

- (a) -4 (b) -2 (c) 0 (d) 2 (e) 4

40. Use synthetic division to find the quotient $q(x)$ when $p(x) = x^3 - 4x^2 - 8x + 8$ is divided by $x + 2$. Then state if $x + 2$ is, or is not, a factor of $p(x)$.

- (a) $q(x) = x^2 + 6x - 4$, $x + 2$ is not a factor
(b) $q(x) = x^2 - 8x + 8$, $x + 2$ is a factor
(c) $q(x) = x^2 + 6$, $x + 2$ is not a factor
(d) $q(x) = x^2 - 6x + 4$, $x + 2$ is a factor
(e) $q(x) = x^2 - 6x + 4$, $x + 2$ is not a factor