MATH 1100 SPRING 2015
Common Final Exam April 30, 2015

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: $x^3 \pm a^3 = (x \pm a)(x^2 \mp xa + a^2)$

Slope: $\dfrac{y_2 - y_1}{x_2 - x_1}$

Distance: $\sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2}$

Midpoint: $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$

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

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

Quadratic formula: $\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Parabola Vertex: $\left(\dfrac{-b}{2a}, f\left(\dfrac{-b}{2a}\right)\right), a \neq 0$

Difference quotient: $\dfrac{f(x+h) - f(x)}{h}$

Average rate of change on $[a, b]$**:** $\dfrac{f(b) - f(a)}{b - a}$

Compound Interest: $A = P\left(1 + \dfrac{r}{n}\right)^{nt}$

Continuous Interest: $A = Pe^{rt}$

Exponential Growth: $A(t) = A_0 e^{rt}, r > 0$

Exponential Decay: $A(t) = A_0 e^{-rt}, r > 0$

Logarithms:

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

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

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

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

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

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

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

1. Simplify the expression $\dfrac{(4x^6y^{-2})^{1/2}}{(xy^{-4})^2}$ and rewrite with only positive exponents.

   (a) $4x^5y^2$ (b) $2xy^7$ (c) $2xy^{1/2}$ (d) $4x^5y^2$ (e) $\dfrac{2x}{y^9}$

2. Factor the polynomial completely. $x^3 - 25x + 4x^2 - 100$

   (a) $(x-5)^2(x+4)$ (b) $(x^2-25)(x+4)$ (c) $(x^2+25)(x+4)$
   (d) $(x+5)(x-5)(x+4)$ (e) will not factor

3. Solve the equation $3[-3x + 4 - 7(x+1)] = 2x + 5$.

   (a) $-\dfrac{38}{3}$ (b) $-\dfrac{19}{16}$ (c) $-\dfrac{14}{3}$ (d) $\dfrac{2}{3}$ (e) $-\dfrac{7}{16}$

4. Simplify the complex rational expression $\dfrac{9+\frac{3}{x}}{\frac{x}{4}+\frac{1}{12}}$ and write your answer as a proper fraction.

   (a) $\dfrac{36}{x}$ (b) $\dfrac{x}{36}$ (c) 1 (d) $\dfrac{12}{x+1}$ (e) 36

5. Solve the equation for x: $\dfrac{4}{x} + 7 = \dfrac{1}{2x} + \dfrac{14}{5}$.

   (a) $\dfrac{6}{5}$ (b) $\dfrac{5}{6}$ (c) $-\dfrac{5}{6}$ (d) $-\dfrac{6}{5}$ (e) no solutions

6. Which of the statements below best describe the solution(s) of the equation $2x^2 + 5x = 3$?

   (a) there are two solutions, both are positive
   (b) there is one solution and it is positive
   (c) there are two solutions, one positive and one negative
   (d) there is one solution and it is negative
   (e) there are two solutions, both are negative

7. Solve the inequality and express the solution in interval notation: $0 \leq 2 - 3x < 2$.

   (a) $[-2, 0)$ (b) $[-\frac{2}{3}, 0)$ (c) $(\frac{2}{3}, 0]$ (d) $(0, \frac{2}{3}]$ (e) $(-2, 2]$

8. Find the slope of the line that passes through the points $(-2, 3)$ and $(4, 3)$.

   (a) 1 (b) 0 (c) 6 (d) -1 (e) The slope is undefined

9. What is the slope and y-intercept of the line with equation $3x - 2y + 6 = 0$?

   (a) slope = $\frac{2}{3}$, y-intercept is $(0, 6)$ (b) slope = -3, y-intercept is $(0, 6)$
   (c) slope = $\frac{3}{2}$, y-intercept is $(0, 3)$ (d) slope = $-\frac{2}{3}$, y-intercept is $(0, 3)$
   (e) slope = 3, y-intercept is $(0, 6)$

10. Find the equation of the line that is perpendicular to the line with equation $2x + 3y = 4$ that passes through the point $(4, 6)$.

    (a) $y = -\frac{2}{3}x$ (b) $y = -\frac{3}{2}x$ (c) $y = \frac{3}{2}x$ (d) $y = \frac{2}{3}x + 3$ (e) $y = \frac{3}{2}x + 6$

11. Solve the inequality $|3x - 6| - 2 < 10$ and express the solution in interval notation.

    (a) $(-\frac{2}{3}, 6)$ (b) $(-4, 6)$ (c) $(-2, 6)$ (d) $(-6, 4)$ (e) $(-12, 12)$

12. Find the center and radius of the circle $x^2 + y^2 - 8x - 6y - 24 = 0$.

    (a) $C(-4, -3), r = 49$ (b) $C(-4, -3), r = 7$ (c) $C(4, 3), r = 24$
    (d) $C(4, 3), r = 7$ (e) $C(3, 4), r = 24$

13. Find the vertex of the parabola that is the graph of the function $f(x) = x^2 + 16x + 60$.

    (a) $(8, -4)$ (b) $(8, 4)$ (c) $(-8, 0)$ (d) $(-8, 4)$ (e) $(-8, -4)$

14. The profit a vendor makes by selling x pretzels per day is given by the function $P(x) = -.004x^2 + 2.8x - 200$. How many pretzels must be sold per day to get the greatest profit?

    (a) 300 (b) 350 (c) 400 (d) 290 (e) 500

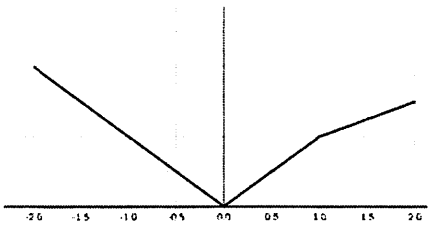
15. Which of the following functions has no real zeros?

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

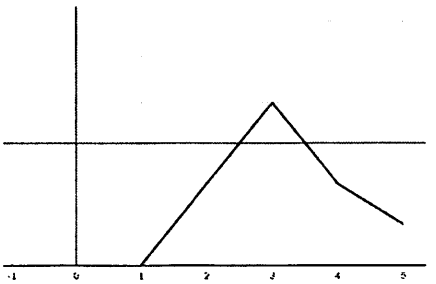
16. A piecewise defined function is defined by $f(x) = \begin{cases} \dfrac{x^2+4}{x+2} & \text{, if } x \neq -2 \\ x - 3 & \text{, if } x = -2 \end{cases}$. Find the sum $f(-2) + f(-4)$.

    (a) 0 (b) -15 (c) -6 (d) 8 (e) -1

17. Given the graph $y = f(x)$ as sketched to the right, using graph transforms, decide which of the following graphs could be the graph of $y = -2\,f(x-3)+1$.



(a)



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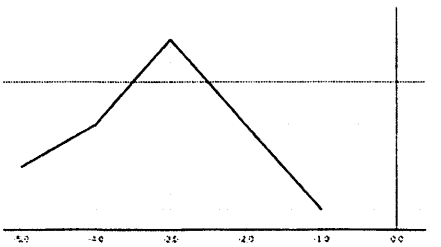

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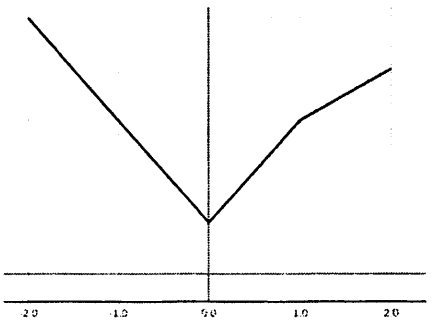
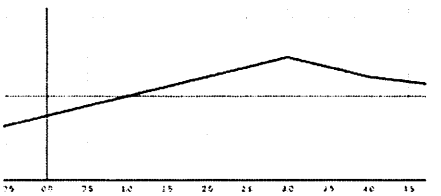


(d)



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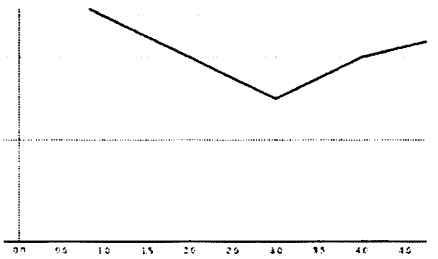

18. Solve the inequality $x^2 - 3x \geq -2$ and express the solution in interval notation.

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

19. The graph of $F(x) = a\,(x-2)(2x+1)$ passes through the point $(3, -7)$. Find the value of a.

(a) 1 (b) -1 (c) 3 (d) -7 (e) -4

20. If $g(x) = \sqrt{2-3x}$, what is the domain of the function g?

(a) $[-\frac{2}{3}, \infty)$ (b) $[\frac{2}{3}, \infty)$ (c) $(-\infty, \frac{2}{3}]$ (d) $(-\infty, -\frac{2}{3}]$ (e) $[0, \infty)$

21. Find the midpoint of the line segment that connects $(4, -3)$ and $(-6, 2)$.

(a) $(1, \frac{1}{2})$ (b) $(-2, -5)$ (c) $(-1, 1)$ (d) $(-2, -1)$ (e) $(-1, -\frac{1}{2})$

22. Which of the statements below best describes the solution(s) of the equation $x - \sqrt{3x - 2} = 4$?

(a) there are two solutions, both positive
(b) there are two solutions, both are negative
(c) there is one solution, and it is positive
(d) there is one solution, and it is negative
(e) there are no solutions

23. Suppose that $(4, 3)$ is a point on the circle that has its center at the point $(-3, 4)$. Find the radius of the circle.

(a) $2\sqrt{5}$ (b) 7 (c) $5\sqrt{2}$ (d) $2\sqrt{3}$ (e) $7\sqrt{2}$

24. Let $f(x) = \sqrt{2x - 1}$ and $g(x) = x^2 - 3$. Find the value of $(g \circ f)(3)$.

(a) 6 (b) $\sqrt{2}$ (c) 7 (d) $\sqrt{11}$ (e) 2

25. Find the domain of the function $f(x) = \dfrac{x + 1}{2x^2 - 8}$.

(a) $x \neq 8$ (b) $x \neq -1$ (c) all real numbers (d) $x \neq \pm 2$ (e) $x \neq 0$

26. For the function $f(x) = \dfrac{5x - 3}{8}$, find the inverse function $f^{-1}(x)$.

(a) $\dfrac{8}{5x - 3}$ (b) $\dfrac{8x + 3}{5}$ (c) $\dfrac{3x - 8}{5}$ (d) $\dfrac{8}{5x + 3}$ (e) $-\frac{8}{3} - \frac{5}{3x}$

27. Solve the inequality $\dfrac{3x + 7}{14 - 7x} \geq 0$ and express the solution in interval notation.

(a) $(-\infty, \frac{7}{3}] \cup (2, \infty)$ (b) $[-\frac{7}{3}, 2)$ (c) $(-\infty, -\frac{7}{3}] \cup [2, \infty)$ (d) $[-\frac{7}{3}, 2]$ (e) $[\frac{7}{3}, 2)$

28. Which of the following numbers does not belong in the list of possible rational zeros of the polynomial $p(x) = 2x^5 - 3x^4 - 2x + 9$?

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

29. Identify the Horizontal Asymptote (if any) of the function $f(x) = \dfrac{25x}{5x^2+1}$.

(a) $y = 5$ (b) $y = \dfrac{1}{5}$ (c) $y = 0$ (d) $y = 5x$ (e) none

30. Identify the Vertical Asymptotes (VA) $f(x) = \dfrac{3x+1}{x(3x-1)}$.

(a) $x = \dfrac{1}{3}$ (b) $x = 0, x = \dfrac{1}{3}$ (c) $x = 3$ (d) $x = -\dfrac{1}{3}$ (e) there are none

31. Solve the equation $x^3 + 6x^2 - x - 6 = 0$ given that one solution is $x = -1$.

(a) $\{-1, \sqrt[3]{6}\}$ (b) $\{-1, 6\}$ (c) $\{-1, -6\}$ (d) $\{-1, 1, 6\}$ (e) $\{-1, 1, -6\}$

32. Which of the polynomials below have end-behavior down on left and up on the right and cross the x-axis at $x = -3$ and touch the x-axis at $x = 3$?

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

33. Solve for x in the equation $3^{x+7} = 4$.

(a) $\dfrac{\ln(3) - 7\ln(4)}{\ln(4)}$ (b) $\dfrac{\ln(4)}{\ln(3)} + 7$ (c) $7\ln(3) - \ln(4)$ (d) $\dfrac{\ln(4) - 7\ln(3)}{\ln(3)}$ (e) $\dfrac{\ln(3)}{\ln(4)} + 7$

34. Solve the equation $\log_4(x+3) + \log_4(x-3) = 2$.

(a) 5 (b) $\dfrac{5}{2}$ (c) 6 (d) -5 (e) $\{5, -5\}$

35. Solve the equation $\log_3(4x-1) = -1$.

(a) $\dfrac{1}{3}$ (b) 3 (c) $\dfrac{3}{4}$ (d) $\dfrac{4}{3}$ (e) 2

36. Use the rules of logarithms to rewrite as a single logarithm expression: $3\ln(x) - \dfrac{1}{3}\ln(y)$.

(a) $\ln(x^3\sqrt{y})$ (b) $\ln\left(\dfrac{x^3}{y^3}\right)$ (c) $\ln(x^3y^3)$ (d) $\ln\left(\dfrac{x^3}{\sqrt[3]{y}}\right)$ (e) $x^3\ln\left(\sqrt[3]{y}\right)$

37. Suppose your professor gets a one-time bonus (for the stellar job he or she has done teaching MATH 1100) and decides to invest it in an account that pays 8.5% interest compounded continuously. Your professor calculates that the account will grow to \$8188.76 in 10 years. How big is the bonus your professor received?

(a) \$4000 (b) \$3300 (c) \$3500 (d) \$3700 (e) \$3400

38. Find the accumulated value of an investment of \$3000 that pays 6% compounded quarterly for 8 years. Approximate to the nearest dollar value.

(a) \$4831 (b) \$3831 (c) \$4860 (d) \$4800 (e) \$3800

39. Let $f(x) = x^3 - 2$ and $g(x) = \sqrt[3]{x+2}$. Choose the correct statement.

(a) f and g are both odd functions
(b) f and g are inverse functions
(c) the graph of f is the graph of x^3 shifted right by 2
(d) the graph g is decreasing on the interval $(-\infty, -2)$
(e) none of the above are true

40. Simplify the difference quotient for $f(x) = 8 - 7x$.

(a) $\dfrac{-7x+8}{h}$ (b) -7 (c) $-7\left(\dfrac{x}{h}\right)+8$ (d) 8 (e) 1