MATH 1100
COMMON FINAL EXAM

FALL 2019

FRIDAY, DEC 6, 2019

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

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

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

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

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

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

Logarithms:

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

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

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

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

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

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

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

1. Which of the following is a factor for the polynomial $x^3 + 2x^2 - x - 2$?

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

2. Solve the equation.

$$2x = -x - 2$$

(a) $\frac{2}{3}$
(b) $-\frac{2}{3}$
(c) $-\frac{2}{5}$
(d) $-\frac{2}{7}$
(e) No solution.

3. Simplify.

$$\frac{\sqrt{8a^5b^3}}{\sqrt{2ab}}$$

(a) $6a^2b^2$
(b) $2a^3b^2$
(c) $2a^2b^3$
(d) $2a^2|b|$
(e) $2ab$

4. Rationalize the denominator.

$$\frac{3}{2-\sqrt{3}}$$

(a) $6+3\sqrt{3}$
(b) $3\sqrt{3}-1$
(c) $\sqrt{3}-1$
(d) $\sqrt{3}+2$
(e) $2\sqrt{3}+1$

5. Find the product of the polynomial $(2x-1)(3x^2+1)$

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

6. Let $f(x)$ be an even function. The points $(1,2)$ and $(-3,3)$ are on the graph of $f(x)$. Find the value of $f(-1)+f(3)$

(a) $f(-1)+f(3)=3$
(b) $f(-1)+f(3)=4$
(c) $f(-1)+f(3)=5$
(d) $f(-1)+f(3)=-6$
(e) $f(-1)+f(3)=7$

7. List all possible rational zeros for $P(x) = 2x^4 - x^3 + x^2 - 5x - 2$ as given by the Rational Zero Theorem.

(a) $\{\pm 1, \pm 2, \pm 3, \pm \frac{1}{5}, \pm \frac{2}{5}\}$
(b) $\{\pm 1, \pm 2, \pm 3, \pm \frac{1}{2}, \pm \frac{3}{2}\}$
(c) $\{\pm 1, \pm 2, \pm \frac{1}{2}\}$
(d) $\{1, 2, \frac{1}{2}\}$
(e) $\{\pm 1, \pm 5, \pm \frac{1}{2}\}$

8. Let $f(x) = |x|$. Shift the graph of $f(x)$ left by 2 and then shift down by 3, we obtain a new function $g(x)$. Find the formula $g(x)$.

(a) $g(x) = |x + 2| - 3$
(b) $g(x) = |x - 2| - 3$
(c) $g(x) = |x + 2| + 3$
(d) $g(x) = |x - 2| - 3$
(e) $g(x) = |x - 3| + 2$

9. Solve for radius r in the formula of disk area A.

$$A = \pi r^2$$

(a) $r = \sqrt{\frac{A^2}{\pi}}$
(b) $r = \sqrt{\frac{\pi}{A}}$
(c) $r = \sqrt{\frac{A}{2\pi}}$
(d) $r = \sqrt{\frac{2A}{\pi}}$
(e) $r = \sqrt{\frac{A}{\pi}}$

10. Suppose that y varies directly as the square root of x, and that $y = 36$ when $x = 16$. What is the y when $x = 9$?

(a) 26
(b) 27
(c) 29
(d) $5\sqrt{3}$
(e) 3.5

11. Solve the radical equation and then choose the correct statement.

$$\sqrt{1+2x} = x - 1$$

(a) The equation has one negative real solution.
(b) The equation has one positive solution.
(c) The equation has two solutions.
(d) The equation has three solutions.
(e) The equation has no solution.

12. Solve the inequality.

$$-1 - 3x < 5$$

(a) $(-\frac{4}{3}, \infty)$
(b) $(-2, \infty)$
(c) $(-\infty, -\frac{4}{3})$
(d) $(-\infty, \frac{4}{3})$
(e) no solution

13. Solve the inequality.

$$2|1-x|-1 \leq -5$$

(a) $[0, \infty)$
(b) $[-2, 3]$
(c) $(-1, 3)$
(d) $[-\infty, 3]$
(e) No solutions.

14. Solve the quadratic inequality.

$$-2x + x^2 \leq 3$$

(a) $(-\infty, -3] \cup (1, \infty)$.
(b) $(-\infty, -1] \cup [3, \infty)$.
(c) $[-1, 3]$
(d) $(-\infty, -2]$
(e) $(-\infty, 0) \cup (\sqrt{3}, \infty)$.

15. Solve the rational inequality.

$$\frac{1-2x}{3x+2} > 0$$

(a) $(-\infty, -\frac{2}{3}) \cup [\frac{1}{2}, \infty)$
(b) $(-\frac{2}{3}, \frac{1}{2})$
(c) $(-\infty, -\frac{2}{3}) \cup (\frac{1}{2}, \infty)$
(d) $(-\infty, -\frac{2}{3}) \cup (\frac{1}{3}, \infty)$
(e) $[-3, -\frac{2}{3}]$

16. Solve the quadratic equation

$$2x^2 + 3 = -7x$$

(a) $x = \frac{-7 \pm \sqrt{73}}{2}$.
(b) $x = -3, -\frac{1}{2}$.
(c) $x = \frac{-7 \pm \sqrt{73}}{4}$.
(d) The equation has one positive solution and one negative solution.
(e) No real solution.

17. Find the distance from $A = (1, 1)$ to $B = (-4, -11)$.

(a) 12
(b) $\sqrt{150}$
(c) 13
(d) $\sqrt{35}$
(e) -15

18. Find the equation of the line with slope $m = \frac{3}{2}$ and passing through $Q(0, -5)$.

(a) $y = -\frac{3}{2}x - 5$
(b) $y = \frac{3}{2}x - 5$
(c) $y = \frac{2}{3}x - 5$
(d) $y = \frac{3}{2}x + 5$
(e) $y = -\frac{3}{2}x + 5$

19. Two lines have equations $y = \frac{5}{2}x + 31$ and $2x = 5 - 5y$. Choose the correct statement.

(a) The lines are parallel.
(b) The lines have two common points.
(c) The lines have the same y-intercepts.
(d) The lines are perpendicular.
(e) One of the lines is horizontal.

20. Find the center and radius of the following circle.

$$x^2 + y^2 - 4x + 4y - 8 = 0$$

(a) $(2, -2), r = 4$
(b) $(-2, 2), r = 1$
(c) $(2, -2), r = 2$
(d) $(1, -2), r = 3$
(e) $(2, -5), r = 1$

21. Find the coordinates of the midpoint of $A(-3, -4)$ and $B(5, 6)$.

(a) $(4, 3)$
(b) $(7, 8)$
(c) $(2, 2)$
(d) $(4, 5)$
(e) $(1, 1)$

22. Evaluate the quantity $A = f(3) + f(-3)$ where the function $f(x)$ is defined as follows

$$f(x) = \begin{cases} 2x - 1 & x \leq 2 \\ x^2 - x + 1 & x > 2 \end{cases}$$

(a) -2
(b) -1
(c) 0
(d) 1
(e) 2

23. If the points $(2, 3), (3, -2)$ and $(-2, 1)$ are on the graph of a one-to-one function $f(x)$, find the value of $f(2) + f^{-1}(-2)$.

(a) 3
(b) 4
(c) 5
(d) 6
(e) 7

24. For $f(x) = x^2 + 2x$ and $g(x) = \sqrt{5x + 1}$, evaluate $f \circ g(3)$.

(a) 17
(b) 20
(c) 24
(d) 14
(e) 15

25. Find the domain of the function $f(x)$.

$$f(x) = \sqrt{-1 - 2x}$$

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

26. Determine the remainder R that results when $4x^{1100} - 6x^2 - 5x + 9$ is divided by $x - 1$. You may use the remainder theorem.

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

27. Solve the equation and round your answer to four decimal places.

$$3^{2x} - 11 = 0$$

(a) 0.8856
(b) 0.1942
(c) 1.0913
(d) 0.6161
(e) -0.3143

28. Find the inverse function for $f(x) = \frac{2}{x+1}$.

(a) $f^{-1}(x) = \frac{2}{x} - 1$
(b) $f^{-1}(x) = \frac{2}{x} + 1$
(c) $f^{-1}(x) = \frac{2}{x+5} + 1$
(d) $f^{-1}(x) = \frac{2}{x+3} - 1$
(e) No inverse function.

29. The graph of a 3rd degree polynomial $p(x)$ has zeros $-3, 0, 5$ and it passes point $(2, 5)$. Find its leading coefficient a.

(a) $-\frac{1}{6}$
(b) $\frac{1}{2}$
(c) $-\frac{1}{2}$
(d) $-\frac{1}{5}$
(e) 1

30. It is known that $x = 1$ is a solution of the following equation: $x^3 - 5x^2 - 2x + 6 = 0$. Solve the equation, then find the sum of the three solutions.

(a) -4
(b) -8
(c) 5
(d) 2
(e) -5.

31. Find all vertical asymptotes for the function $f(x) = \dfrac{x+1}{x^2 - x - 2}$.

(a) $x = -1, x = 1$
(b) $y = 1$
(c) $x = 2$
(d) $x = 1, x = -2$
(e) $x = -1, x = 2$

32. Find the horizontal asymptote(s) for the function

$$f(x) = \frac{2x^2 + 3x + 1}{x^3 - 2x^2 - 3x + 1}.$$

(a) $y = 2$
(b) $y = 3$
(c) $y = -3$
(d) $y = 0$
(e) No horizontal asymptote.

33. Let $f(x) = 2x^2 + 4x + 11$. Which statement is correct?

(a) f has maximum value 13 at $x = 1$.
(b) f has maximum value 11 at $x = 1$.
(c) f has minimum value 13 at $x = 1$.
(d) f has minimum value 9 at $x = -1$.
(e) f has minimum value 10 at $x = -1$.

34. Use the properties of logarithms to combine the following expression into one logarithm.

$$\frac{1}{3}\ln(x-1) - 2\ln x - \ln 3$$

(a) $\ln\left(\frac{\sqrt[3]{x-1}}{3x^2}\right)$
(b) $\ln\left(\frac{\sqrt{x^2-1}}{3x^2}\right)$
(c) $\ln\left(\frac{3\sqrt{2x-1}}{x^2}\right)$
(d) $\ln\left(\frac{2\sqrt[3]{x-1}}{\sqrt{x}}\right)$
(e) $\ln\left(\frac{2\sqrt{x-1}}{x^2}\right)$

35. Use the properties of logarithms to write $\log\left(\frac{(x-2)}{10(x-1)\sqrt{x}}\right)$ as a sum or difference of simple logarithmic terms.

(a) $\log(x-2) - \log 2 - \frac{1}{2}\log x - \log(x+1)$
(b) $\frac{1}{10}\log(x-2) + \frac{1}{2}\log x - \log(x-1)$
(c) $2\log(x-2) - \log 10 - \frac{1}{2}\log x + \log(x-1)$
(d) $\log(x-2) - 1 - \frac{1}{2}\log x - \log(x-1)$
(e) $-1 - \frac{1}{2}\log x$

36. Solve the equation

$$3^{(3x-1)} = \frac{1}{9}.$$

(a) 1
(b) $-\frac{1}{3}$
(c) $\frac{2}{3}$
(d) 5.1423
(e) 7.8854

37. Use your calculator to find value for $\ln 2 + \log_3 2$. Round your answer to four decimal places.

(a) -1.1983
(b) 4.0122
(c) -3.1243
(d) 1.3241
(e) 0.9320

38. Solve the equation

$$1 + \log_7(x + \frac{8}{7}) = 0$$

(a) 7
(b) 5
(c) 3
(d) -1
(e) No solution

39. How much money would you have if you invested \$1,000 at 4% compounded continuously for 20 years?.

(a) \$2,000
(b) \$ 2,225.54
(c) \$3,500.1
(d) \$750
(e) \$1,070.2

40. Solve the system of linear equations. Find the value for y.

$$\begin{cases} 2x - y &= 0 \\ 3x - 2y &= -1. \end{cases}$$

(a) $y = 1$
(b) $y = 0$
(c) $y = -1$
(d) $y = 2$
(e) $y = -3$