MATH 1100
Common Final Exam

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

Distance formula: $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ **Midpoint formula:** $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$

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:

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

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

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

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

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

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

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

1. Which of the following is a factor of
   $$6x^2 - x - 1?$$

   (a) $2x + 1$

   (b) $6x - 1$

   (c) $6x + 1$

   (d) $2x - 1$

   (e) $3x - 1$

2. Which of the following is a factor of
   $$2x^3 - 16?$$

   (a) $x - 4$

   (b) $x^2 + 2x + 4$

   (c) $x + 2$

   (d) $x^2 - 2x + 4$

   (e) $(x - 2)^2$

3. Simplify the expression $\left(\dfrac{36a^4 b^{-3}}{a^{-2}b} \right)^{\frac{1}{2}}$.

   (a) $\dfrac{6a^3}{b^2}$

   (b) $\dfrac{18a^3}{b^2}$

   (c) $\dfrac{a^3}{6b^2}$

   (d) $\dfrac{b^2}{6a^3}$

   (e) $6a^3 b^2$

4. Simplify and combine the following radicals (if possible). $\sqrt{98} + \sqrt{32}$.

   (a) $\sqrt{130}$

   (b) $9\sqrt{2}$

   (c) $11\sqrt{2}$

   (d) 65

   (e) not possible to simplify

5. Solve the following equation for x. $\dfrac{x}{2} + 6 = \dfrac{3x}{4}$

   (a) 36

   (b) 20

   (c) 28

   (d) 32

   (e) 24

6. Solve the equation for x. $\dfrac{2}{x-1} + \dfrac{3x}{x+2} = \dfrac{6x}{x^2+x-2}$.

   (a) None of answers shown

   (b) $x = \dfrac{4}{3}, x = 1$

   (c) $x = 1$

   (d) $x = \dfrac{4}{3}$

   (e) $x = \dfrac{3}{4}$

7. Solve the following equation $\sqrt{4x-3} + 5 = x + 5$
   Choose the correct statement about the solutions.

   (a) sum of the solutions is 5

   (b) there is one positive and one negative solution

   (c) sum of the solutions is 4

   (d) there is only one positive solution

   (e) no solutions to the equaton

8. Solve the equation for x. $3|x-2| - 6 = 12$

   (a) $x = 4, -8$

   (b) $x = 8, -4$

   (c) $x = 8$

   (d) $x = -4$

   (e) $x = 4, -2$

9. Solve the inequality $4 < 6 - 2x \le 12$.

   (a) $[-3, 1)$

   (b) $(-1, 3]$

   (c) $(-3, 1)$

   (d) $[-1, 3)$

   (e) $(-\infty, -3] \cup (1, \infty)$

10. Solve the inequality $|2x - 1| - 4 < 5$.

    (a) $(-5, 4)$

    (b) $(-4, 5)$

    (c) $[-4, 5)$

    (d) $(-1, 5)$

    (e) $[-4, 5]$

11. Two times a number is eight more than six times the same number. Find the number.

    (a) 2

    (b) 8

    (c) -1

    (d) -3

    (e) -2

12. Quantity y varies directly with the square root of x. y has a value of 8 when x has a value of 16. Find y when $x = 20$. Round your answer to two decimal places.

   (a) 17.89
   (b) 40
   (c) 8.94
   (d) 20
   (e) .89

13. Find the equation of the circle with a diameter having end points of $(-6,4)$ and $(2,4)$.

   (a) $(x + 2)^2 + (y + 4)^2 = 16$
   (b) $(x - 2)^2 + (y - 4)^2 = 8$
   (c) $x^2 + (y - 4)^2 = 64$
   (d) $(x + 2)^2 + (y - 4)^2 = 16$
   (e) $x^2 + y^2 = 64$

14. Given this equation of a circle,

   $x^2 + y^2 - 10x + 20y + 25 = 0$, find the center, $c\,(h, k)$ and radius, r.

   (a) $c\,(5, -10),\ r = 10$
   (b) $c\,(-5, 10),\ r = 100$
   (c) $c\,(5, -10),\ r = 100$
   (d) $c\,(-5, -10),\ r = 25$
   (e) $c\,(5, -10),\ r = 5$

15. Solve the equation for x. $x^2 - 6x + 4 = 0$

   (a) $\{5, 1\}$
   (b) $\{6 + \sqrt{5}, 6 - \sqrt{5}\}$
   (c) no solution
   (d) $\{-4, -2\}$
   (e) $\{3 + \sqrt{5}, 3 - \sqrt{5}\}$

16. Simplify the following rational expression
   $$\frac{3x^2 - 30x + 75}{x - 5}$$

   (a) $x - 5$
   (b) $3x - 5$
   (c) $3x - 15$
   (d) can't be simplified
   (e) $3x + 5$

17. Add the following and express answer in simplest form: $\dfrac{3}{x-7} + \dfrac{4x}{x+4}$

    (a) $4x + 3$

    (b) $\dfrac{x+4}{x-7}$

    (c) $\dfrac{4x+3}{x-7}$

    (d) $\dfrac{4x^2 - 25x + 12}{(x-7)(x+4)}$

    (e) $\dfrac{4x-3}{x+4}$

18. What is the slope of the line between the two points $(-6, 4)$ and $(5, -3)$?

    (a) slope $= -7$

    (b) slope $= -\dfrac{11}{7}$

    (c) undefined slope

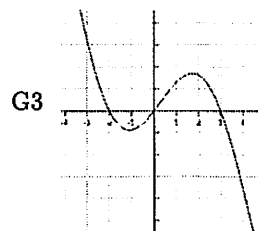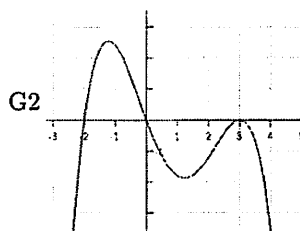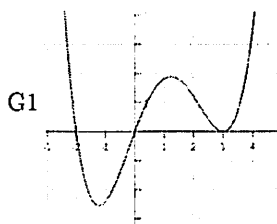   (d) slope $= -\dfrac{7}{11}$

    (e) slope $= 0$

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

    (a) $y = -x$

    (b) $x + y = 2$

    (c) $y = x + 2$

    (d) $y = -2x$

    (e) $y = x - 2$

20. Given $f(x) = -(x+2)^2 + 4$, what is the vertex of this parabola?

    (a) $(2, 4)$

    (b) $(-2, -4)$

    (c) $(-2, 2)$

    (d) $(4, -2)$

    (e) $(-2, 4)$

21. There is a value for r so that the polynomial $y = -3x(x-r)^2(x+2)$ would match one of the graphs $G1, G2$ or $G3$. Determine the value for r and the matching graph.

G1   G2   G3

    (a) $r = 3$ graph $G1$

    (b) $r = -2$ graph $G3$

    (c) $r = 3$ graph $G2$

    (d) $r = 3$ graph $G3$

    (e) $r = -2$ graph $G2$

22. The cost per unit, $c(x)$, when manufacturing x units is given by formula $c(x) = 2x^2 - 28x + 80$. What is the number of units produced that keeps cost of manufacturing to a minimum?

(a) 10

(b) 28

(c) 80

(d) 14

(e) 7

23. Which statement is true about $g(x) = 3x^2 - 7$?

(a) $g(x)$ is an odd function

(b) $g(x)$ is an even function

(c) $g(x)$ is symmetric about the x-axis

(d) $g(x)$ is one-to-one

(e) $g(x)$ is symmetric about the origin

24. Given $f(x) = 3x + 1$ and $g(x) = \sqrt{2x + 1}$, evaluate $(f \circ g)(4)$.

(a) 10

(b) $\sqrt{27}$

(c) 16

(d) 13

(e) $\sqrt{10}$

25. Describe the transform steps to obtain the graph of $g(x) = -|x - 7| + 3$ from $f(x) = |x|$.

(a) shift 7 left, reflect about x axis, then up 3

(b) shift 7 right, reflect about x axis, then up 3

(c) shift 7 right, reflect about y axis, then up 3

(d) shift 3 right, reflect about x axis, then down 7

(e) shift 3 left, reflect about y axis, then up 7

26. If the points $(3, 7), (6, -3), (1, -6)$ and $(-7, -1)$ are on the graph of a one-to-one function $f(x)$, find the value of $f(6) + f^{-1}(-3)$.

(a) -9

(b) -6

(c) -3

(d) 3

(e) 6

27. The function $f(x)$ is piecewise defined as $\quad f(x) = \begin{cases} x - 1 & \text{if } x \leq 5 \\ \sqrt{2x + 1} & \text{if } x > 5 \end{cases}$

Find $f(0) + f(12)$.

(a) 4

(b) 1

(c) 0

(d) -1

(e) 5

28. Let $f(x) = \sqrt{x-3}$ and $g(x) = \sqrt{14-x}$.

Find the domain of $(f+g)(x)$.

(a) $[-3, 14]$

(b) $[-14, 3]$

(c) $[3, 14]$

(d) $(-\infty, \infty)$

(e) $(-\infty, -3] \cup [14, \infty)$

29. State the degree and end behavior for $P(x) = -x(x-3)^2(x+4)^3$.

(a) degree 6, Up/Down

(b) degree 5, Down/Down

(c) degree 6, Up/Up

(d) degree 5, Up/Up

(e) degree 6, Down/Down

30. Given $f(x) = \dfrac{x-2}{x^2+4x-12}$, find the vertical asymptote(s). (if any)

(a) $x = 2, x = -6$

(b) $x = 2$

(c) none

(d) $x = -6$

(e) $x = 6, x = -2$

31. Given $g(x) = \dfrac{2x^3 - 7x^2 + 4x - 11}{-x^3 + 4x + 2}$. Find the horizontal asymptote(s). (if any)

(a) $y = 0$

(b) $x = -2$

(c) none

(d) $y = -2$

(e) $y = 2$

32. Solve the inequality $x^2 \leq -4x + 12$.

(a) $[-2, 6]$

(b) $(-6, 2)$

(c) $[-6, 2]$

(d) $(-2, 6)$

(e) $(-\infty, -6] \cup [2, \infty)$

33. Solve the inequality $\dfrac{x-4}{2x+6} < 0$.

(a) $[-3, 4]$

(b) $(-3, 4)$

(c) $[-4, 3]$

(d) $(-\infty, -3) \cup (4, \infty)$

(e) $(-\infty, -3] \cup [4, \infty)$

34. Combine the expression

$4\log_b (2) + 2\log_b (x) - \frac{1}{2}\log_b (16)$ into a single logarithm.

(a) $\log_b \left[4x^2\right]$

(b) $\log_b \left[2x^2\right]$

(c) $\log_b \left[16x^2\right]$

(d) $\log_b \left[\dfrac{16}{x^2}\right]$

(e) $\log_b [4\sqrt{x}]$

35. Solve for x, $\log_5 (x+2) + 3 = 4$.

(a) 4

(b) 2

(c) none shown

(d) 5

(e) 3

36. Solve for x in the equation $3^{2x} = 9^{-x+2}$.

The answer lies in what interval?

(a) $(-\infty, -3)$

(b) $(-2, 0)$

(c) $(0, 2)$

(d) $(3, 5)$

(e) $(6, \infty)$

37. Solve the equation $25e^{-5x} = 15$.

Round your answer to four decimal places.

(a) $-.5416$

(b) $.1022$

(c) $-.6438$

(d) $-.1022$

(e) $.2197$

38. Meredith inherits $8000 and invests this money in an account paying 5.5% interest compounded continuously. How much money will be in the account after 10 years? (assuming Meredith doesn't withdraw any money).

(a) $13,866.02$

(b) $12,866.02$

(c) $11,866.02$

(d) $15,866.02$

(e) $18,866.02$

39. It is known that $x = 2$ is a zero of $P(x) = 4x^3 - 10x^2 - 2x + 12$.

What is the <u>sum</u> of all of the real zeros of this polynomial?

(a) 2

(b) $\dfrac{5}{2}$

(c) $\dfrac{3}{2}$

(d) -1

(e) 0

40. Which of the following statements is true about the solution to this system of equations? $\left\{ \begin{array}{l} 2x + y = 9 \\ 3x - y = 16 \end{array} \right\}$

(a) $y = 5$

(b) $x = -5$

(c) $y = -1$

(d) $y = 0$

(e) $y = 3$