

UNIVERSITY OF SASKATCHEWAN
Department of Mathematics & Statistics
Mathematics 101 Final Examination

April, 2000

Time: 3 hours

Instructors: *Bremner/Szmigielski*

CLOSED BOOK — CALCULATORS ARE NOT PERMITTED

EACH PROBLEM IS WORTH 1 PT.

PART I: The answers to all questions are the digits in **ANSWER SET I:**

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4 (F) 5 (G) 6 (H) 7 (I) 8 (J) 9

If $\frac{5}{7} - \frac{7}{11}$ is written in its simplest form as $\frac{a}{10b+c}$, where $a, b,$ and c are digits, then

(1) $a =$

(2) $b =$

(3) $c =$

If the roots of $4x^2 - 3x - 2 = 0$ are written in their simplest form as $\frac{a \pm \sqrt{10b+c}}{d}$, where a, b, c and d are digits, then

(4) $a =$

(5) $b =$

(6) $c =$

(7) $d =$

Completing the square in $2x^2 - 12x + 25$ gives the expression $a(x - b)^2 + c$, where

(8) $a =$

(9) $b =$

(10) $c =$

The solution set of the inequality $5 - 4x - x^2 \geq 0$ is the interval $[-a, b]$ where

(11) $a =$

(12) $b =$

The solution set of the equation $|5x - 2| = |7 - x|$ is $\{\frac{a}{b}, -\frac{c}{d}\}$ where

(13) $a =$

(14) $b =$

(15) $c =$

(16) $d =$

The slope-intercept form of the equation of the line joining $(-1, -9)$ and $(3, -1)$ is $y = ax - b$ where

(17) $a =$

(18) $b =$

If d is the distance between the points $(2, -1)$ and $(5, 3)$ then

(19) $d =$

The circle $x^2 + y^2 - 2x + 4y - 4 = 0$ has centre at $(a, -b)$ and radius r where

(20) $a =$

(21) $b =$

(22) $r =$

The natural domain of the function $f(x) = \sqrt{\frac{x^2-4}{x-4}}$ is the set $[-a, a] \cup (b, \infty)$ where

(23) $a =$

(24) $b =$

Evaluate the logarithms:

(24) $\log_{10} 1000,$

(25) $-4 \ln \frac{1}{e}$ **(26)** $2 \ln 4 + \ln 1 - 4 \ln 2$

(27) $\lim_{h \rightarrow 0} \frac{\ln(1+h)^3}{h},$

If $\log_8 128 = \frac{e}{f}$ then **(28)** $e =$ and **(29)** $f =$

Find $f'(1)$ if:

(30) $f(x) = \pi + (2x - 1)^3$ **(31)** $f(x) = 16\sqrt{x^2 + 3}$ **(32)** $f(x) = e^{\ln x^2}$

(33) $f(x) = 8 \ln(3x + 5)$ **(34)** $f(x) = 8e^{(x^2-1)^{\frac{3}{2}}}$ **(35)** $f(x) = \frac{1}{20}(x^2 + 1)^5$

Find $f''(1)$ if:

(36) $f(x) = -\ln[(x + 2)^9]$ **(37)** $f(x) = 3x^2 + 10x + 4$ **(38)** $f(x) = x^2 e^{(x-1)}$

(39) Suppose f^{-1} denotes the inverse of a function f . Compute $f^{-1}(-1)$ if $f(x) = \frac{x-1}{x+1}$

(40) Find the slope of the tangent line to the curve (trisectrix) $y^3 + yx^2 + x^2 - 3y^2 = 0$ at $x = 0, y = 3$

Solve for x :

(41) $\log_4 4^x = 7$

(42) $\log_3 x^2 + \log_3 x = 3$

(43) $\log_{10} x^{\frac{5}{2}} - \log_{10} \sqrt{x} = \log_{10} 25$

PART II:

The answers to all questions in this part should be chosen from the following list

ANSWER SET II:

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4 (F) 5 (G) 6 (H) $+\infty$ (I) $-\infty$ (J) does not exist

Let $f(x) = x^2$ and $g(x) = x + 1$. Then

$$(44) (f + g)(-2) = \quad (45) (fg)(-1) = \quad (46) (f \circ g)(1) = \quad (47) (g \circ f)(2) =$$

Let $f(x) = x^2 - 2x + 3$ and $g(x) = x^2 - 8x + 23$. Then $g(x) = f(x - a) + b$ for

$$(48) a = \quad (49) b =$$

Consider the three functions $2x^2 - 4x + 6$ and $x^3 + 4x$ and $x^4 + 2x^2 + 3$. Only one of these functions is even; call it $f(x)$, only one of these functions is odd; call it $g(x)$. Then

$$(50) f(1) = \quad (51) g(1) =$$

The rational function $f(x) = \frac{(6x^2+5)}{(x^2-x-6)}$ has vertical asymptotes at $x = -a$ and $x = b$ and a horizontal asymptote at $y = c$ where

$$(52) a = \quad (53) b = \quad (54) c =$$

Determine the following limits:

$$(55) \lim_{x \rightarrow -2} 2 = \quad (56) \lim_{x \rightarrow -1} -3x = \quad (57) \lim_{x \rightarrow +\infty} \frac{100}{x} =$$

Suppose that $\lim_{x \rightarrow 0} f(x) = 4$ and $\lim_{x \rightarrow 0} g(x) = -1$. Then

$$(58) \lim_{x \rightarrow 0} |2f(x) + 10g(x)| = \quad (59) \lim_{x \rightarrow 0} [\sqrt{f(x)} - g(x)^2] =$$

Let $f(x) = -x^3 + 2x^2 + 3x - 4$. Then

$$(60) \lim_{x \rightarrow 2} f(x) = \quad (61) \lim_{x \rightarrow +\infty} f(x) = \quad (62) \lim_{x \rightarrow -\infty} f(x) =$$

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

$$(63) \lim_{x \rightarrow 1^-} f(x) = \quad (64) \lim_{x \rightarrow 1^+} f(x) = \quad (65) \lim_{x \rightarrow 1} f(x) =$$

The function $f(x) = \frac{(x-1)}{\sqrt[3]{x-3}}$ is not continuous at $x = a$ where

$$(66) a =$$

Suppose that $f(x)$ and $g(x)$ are continuous at $x = 3$ and the $\lim_{x \rightarrow 3} [(\log_3 x^2)f(x) - xg(x)] = 7$. If $f(3) = 8$

then $g(3) = a$ where

$$(67) a =$$

Consider the function

$$f(x) = \begin{cases} x - 3, & \text{for } x < 0 \\ (x - 1)^2 - 2k, & \text{for } x \geq 0 \end{cases}$$

The value of k for which $f(x)$ is continuous at $x = 0$ is

$$(68) k =$$
