UNIVERSITY OF SASKATCHEWAN
Department of Mathematics & Statistics
Mathematics 101.3 Final Examination

December 16, 1999 Time:3 hours Instructors: *Lorer, MacLean, Marshall*

CLOSED BOOK — CALCULATORS ARE NOT PERMITTED

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 $\frac{8}{9} - \frac{6}{7}$ is written in its simplest form as $\frac{a}{10b + c}$, where a, b, and c are digits, then

(1) $a =$ **(2)** $b =$ **(3)** $c =$

$x^2 + 10x + 33$ is to be written in the form $(x + b)^2 + c$ by completing squares.

We must have: **(4)** $b =$ **(5)** $c =$

$7x^2 + 112x + 490$ is to be written in the form $7[(x + b)^2 + c]$ by completing squares.

We must have: **(6)** $b =$ **(7)** $c =$

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(8) If m is the slope of the line through the points $(10, 15)$ and $(20, 75)$, then m is:

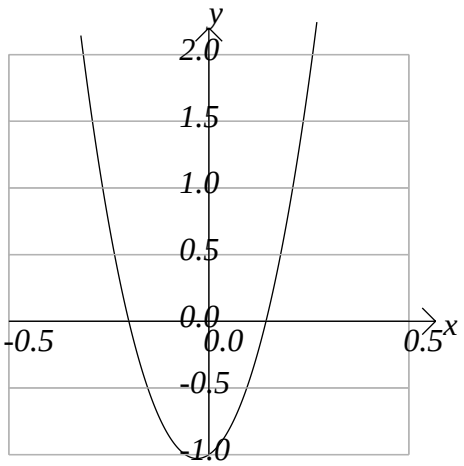
The roots of $4x^2 + 3x - 3 = 0$ in their simplest form are $\frac{-a \pm \sqrt{10b + c}}{d}$. We must have:

(9) $a =$ **(10)** $b =$ **(11)** $c =$ **(12)** $d =$

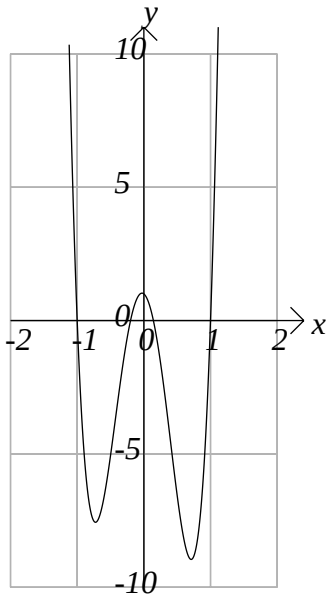
$\frac{3\sqrt{7} + \sqrt{3}}{\sqrt{7} - \sqrt{3}}$ can be simplified to the expression $a + \sqrt{10b + c}$, where a, b, and c are digits.
Their values are: **(13)** $a =$ **(14)** $b =$ **(15)** $c =$

...2

The polynomial $p(x) = 35x^4 + 2x^3 + 34x^2 + 2x - 1$ can be factored in the form $(x^2 + a^2)(bx + 1)(cx - 1)$, where a, b, and c are digits. Its graph is shown to the right.
We must have: **(16)** $a =$ **(17)** $b =$ **(18)** $c =$



The polynomial $p(x) = 35x^4 + 2x^3 - 36x^2 - 2x + 1$ can be factored in the form $(x^2 - a^2)(bx + 1)(cx - 1)$, where a, b, and c are digits. Its graph is shown to the right.
We must have: **(19)** $a =$ **(20)** $b =$ **(21)** $c =$



If we solve the inequality $\left|\frac{1-x}{17}\right| < 1$, the solution is an interval of the form $(-(10+a), 10+b)$.

The values of a and b are: **(22)** $a =$ **(23)** $b =$

Consider the line perpendicular to the line $y = \frac{8x}{5} + 1$ which passes through the point $\left(\frac{40}{13}, \frac{40}{13}\right)$

(24) What is its x-intercept? **(25)** What is its y-intercept?

Evaluate the limits: **(26)** $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ if $f(x) = \frac{16}{(x+2)^2}$ and $x = -4$

...3

(27) $\lim_{x\to 2} \dfrac{5x^2 - 5x - 210}{5x - 35}$

(28) $\lim_{x\to 6} \dfrac{x^2 - 8x + 12}{x - 6}$

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(29) The natural domain of the function $f(x) = \ln(1 - 7x^2)$ is of the form $\left(-\dfrac{1}{\sqrt{a}}, \dfrac{1}{\sqrt{a}}\right)$. a =?

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(30) Let $f(x) = \dfrac{(x+1)^3}{(x+5)^3}$. Find $\dfrac{f'(-6)}{100}$

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(31) The minimum value of $f(x) = 3x^2 - 18x + 30$ is:

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(32) Find the solution of the equation $2^{3x-1} = 256$:

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(33) The largest solution of $\ln(x+4) + \ln(x+5) = \ln(18x)$ is:

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(34) Find the absolute maximum value of the function $f(x) = 2 + x^2 e^{2-x}$ over the interval $[0, 3]$.

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(35) Two non-negative numbers must add up to 16. If they are chosen so as to make their product as large as possible, then one-sixteenth of the maximum value of their product is:

Evaluate the logarithms:

If $\log_2 4096 = 10a + b$ then **(36)** a = and **(37)** b =

If $\log_{125} 625 = \dfrac{c}{d}$ then **(38)** c = and **(39)** d =

If $\log_9 243 = \dfrac{e}{f}$ then **(40)** e = and **(41)** f =

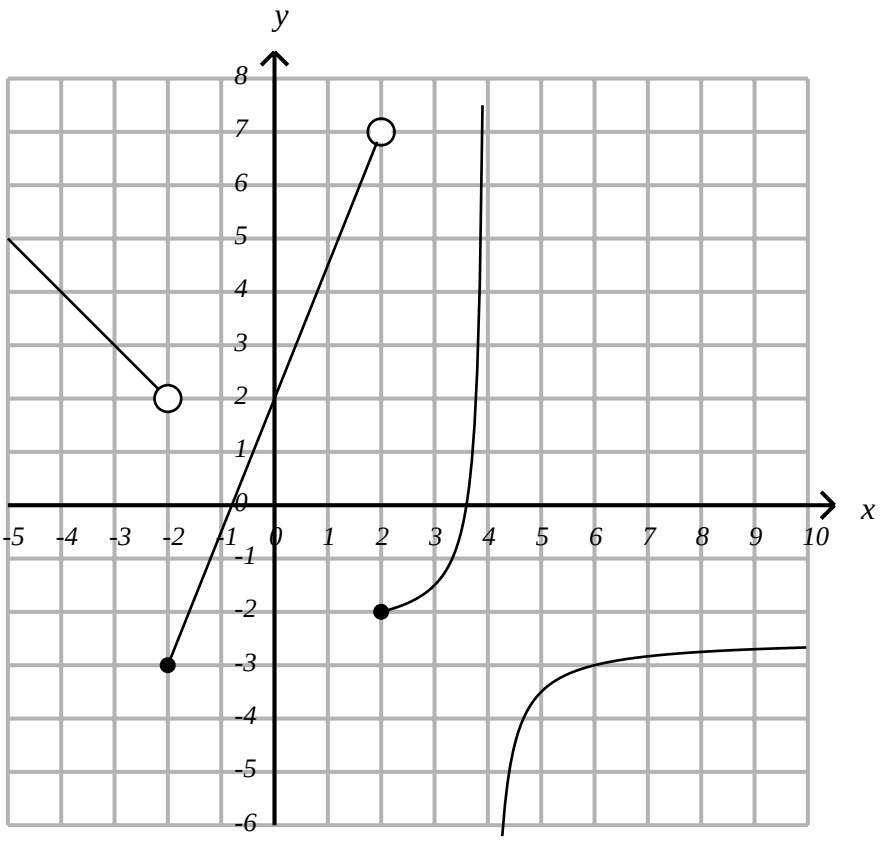
...4

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

(A) $-\infty$	(B) -3	(C) -2.5	(D) -2	(E) 0	(F) 1	(G) 2	(H) 4	(I) 7	(J) ∞

(42) $\lim\limits_{x\to 5^-} \dfrac{6x-19}{x-5}$ =?

(43) $\lim\limits_{x\to 5^+} \dfrac{6x-19}{x-5}$ =?



Part of the graph of $y = f(x) = \begin{cases} -x & \text{if } x < -2 \\ \frac{5}{2}x + 2 & \text{if } -2 \le x < 2 \\ \dfrac{1}{4-x} - 2.5 & \text{if } 2 \le x \text{ and } x \ne 4 \end{cases}$ is shown above.

Find:

(44) $\lim\limits_{x\to -\infty} f(x)$ **(45)** $\lim\limits_{x\to -2^-} f(x)$ **(46)** $\lim\limits_{x\to -2^+} f(x)$ **(47)** $\lim\limits_{x\to 2^-} f(x)$

(48) $\lim\limits_{x\to 2^+} f(x)$ **(49)** $\lim\limits_{x\to 4^-} f(x)$ **(50)** $\lim\limits_{x\to 4^+} f(x)$ **(51)** $\lim\limits_{x\to \infty} f(x)$

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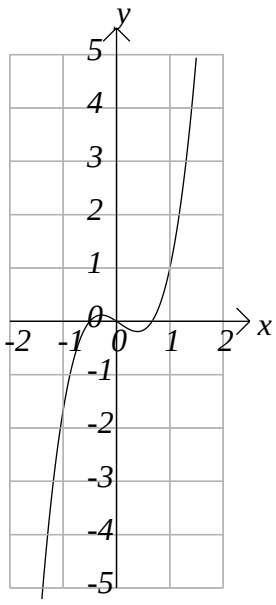
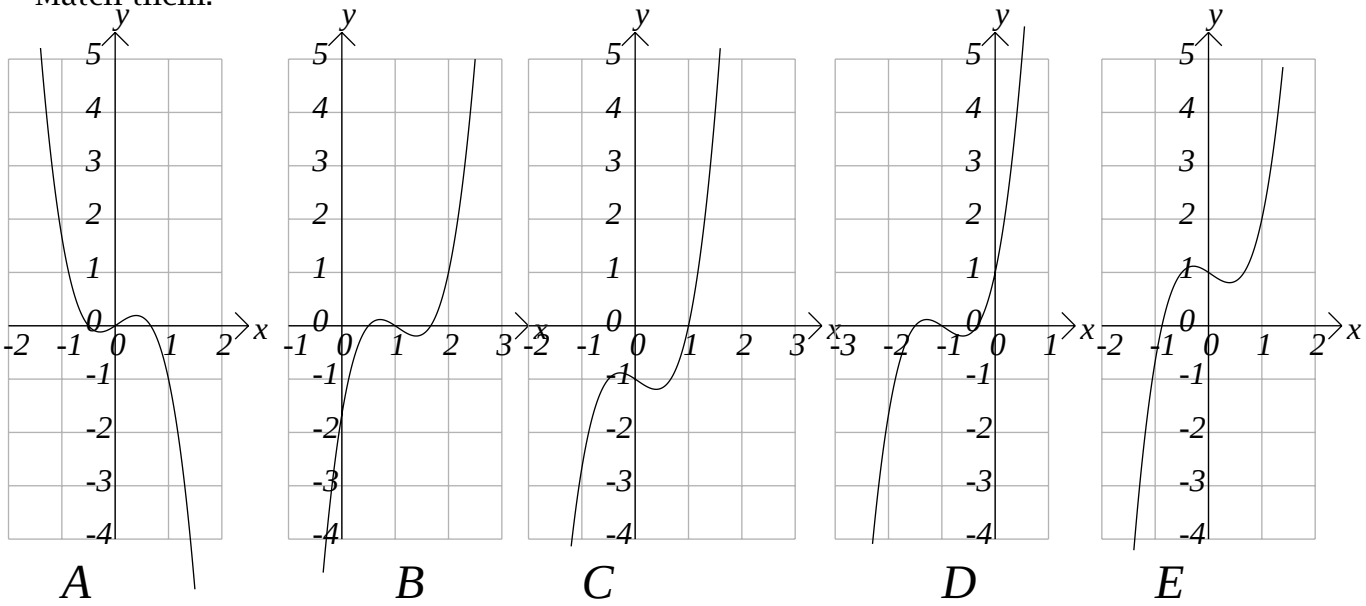
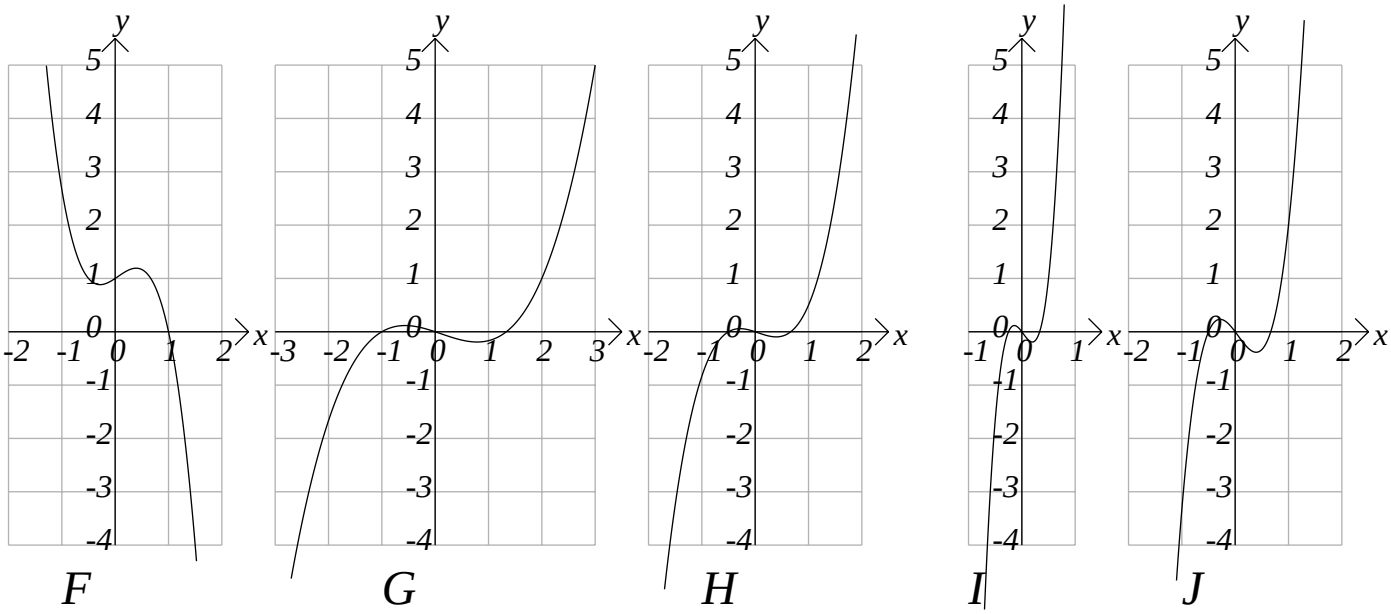
PART III



The graph of
$y = f(x) = x(2x + 1)(3x - 2)/3$
is shown to the right.
Parts of the graphs of
(52) $y = f(x + 1)$,
(53) $y = f(x) - 1$,
(54) $y = f(x - 1)$,
(55) $y = -f(x)$,
(56) $y = 2f(x)$,
(57) $y = f(2x)$,
(58) $y = f(x)/2$,
(59) $y = f(x/2)$, and
(60) $y = -f(x) + 1$, are shown below.
Match them.



A B C D E



F G H I J

…6

The graphs of the functions in questions 61 to 70 are shown below. Match them.

(61) $f(x) = 4x^2 - 3x - 4$

(62) $f(x) = 2x^3 - x^4 + 1$

(63) $f(x) = 3x - 4x^2 - 1$

(64) $f(x) = \dfrac{12x + 3}{2x - 3}$

(65) $f(x) = \dfrac{1}{2}\left(3x - x^3\right)$

(66) $f(x) = \ln(\sqrt{5x + 3})$

(67) $f(x) = \dfrac{1}{10}\left(2x^3 - 3x^2 + 3\right)$

(68) $f(x) = xe^{-x+1}$

(69) $f(x) = \dfrac{1}{20}\left(x^4 - 4x^2\right) - 1$

(70) $f(x) = \dfrac{3x + 2}{3x - 2}$