1. Write the decimal $0.1\overline{27}$ as a fraction in reduced form.

2. Factor the following polynomials completely over the integers:

   (a) $2x^2 + 13x - 15$

   (b) $9a^2 - (4b^2 - 12b + 9)$

3. Simplify completely, leaving your answer free of negative exponents or radicals:

$$\frac{\sqrt[4]{a^8 b^3}}{\sqrt[3]{a^3 b^{-4}}} \cdot \frac{1}{\sqrt[12]{b}}$$

4. Find the equations in slope-intercept form of the following lines:

   (a) the line through $(-1, -4)$ that is parallel to the line $y = -3x + 4$.

   (b) the line through $(-1, -3)$ and $(2, 12)$.

5. Solve the equation $\dfrac{1}{x} + \dfrac{1}{x-1} = \dfrac{8}{3}$.

6. Determine the vertical and horizontal asymptotes of the rational function

$$\frac{x-7}{x^2 - x - 6}$$

7. Determine the natural domains of the functions

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

   (b) $g(x) = \dfrac{1}{\log x}$

8. Solve the equation $\log_3(x^2 + 5) - \log_3(x + 3) = 1$.

9. Evaluate

   (a) $\log_3 27$ (b) $\log_3 \dfrac{1}{81}$ (c) $\log_{27} 3$

10. A certain radioactive substance decays exponentially according to the formula $A(t) = A(0) \cdot 2^{-0.08t}$.

    (a) Compute the half-life of the substance.

    (b) How long does it take for 80 grams of the substance to decay to 10 grams?

    Your final answers should not contain any logarithms!

11. Suppose that t is an angle with $\pi < t < \frac{3\pi}{2}$ and that $\cos t = -\frac{12}{13}$. Compute $\sin t$ and $\cos(2t)$.

12. Prove that

$$\frac{\sin t}{1 - \cos t} = \frac{1 + \cos t}{\sin t}$$

is an identity.

13. Sylvia drove at a constant speed from Pitstop to Backwater, a distance of 150 miles. If she would have driven 10 miles per hour faster, she would have arrived half an hour earlier. How fast was Sylvia driving?

McGILL UNIVERSITY

FACULTY OF SCIENCE

FINAL EXAMINATION

MATHEMATICS 189-112B

FUNDAMENTALS OF MATHEMATICS

Examiner: Dr. A. Hundemer
Associate Examiner: to be announced

Date: Wednesday, April 19, 2000
Time: 2:00 P.M. - 5:00 P.M.

INSTRUCTIONS

Calculators are not permitted
SHOW ALL YOUR WORK!

This exam comprises the cover and 2 pages of questions.