

PROFICIENCY TEST REVIEW SHEET

These problems cover some things you must know in order to get off to a good start in Math 307. There will be a short test on this material on Friday April 4. No calculators or formula sheets will be allowed. If you are having problems, send me an email or come and see me during office hour.

0.1. **Algebra and Trigonometry.** Recommended review: Stewart's Calculus, sections 1.5, 1.6, appendix D

- Write down all values of r that are solutions to the quadratic equation $mr^2 + k = 0$, where m, k are both positive numbers. (hint: complex numbers!)
- Simplify the following expression: $\frac{x^3x^{-1/2}}{x^{-b}}$, where b is a positive constant.
- Simplify the following expression: $\frac{\frac{1}{AB}}{\frac{1}{A} + \frac{1}{B}}$, where A, B are non-zero real numbers.
- Fill in the correct algebraic identity:
 - $e^x e^y = ?$
 - $\ln\left(\frac{a}{b}\right) = ?$
 - $e^{\ln(x)} = ?$
 - $\ln(e^x) = ?$
 - $\ln(1) = ?$
- All of the "identities" below are **false** and are common errors made by students. Find explicit numbers to demonstrate the equality fails.
 - $(x + y)^2 = x^2 + y^2$
 - $e^{x+y} = e^x + e^y$
 - $\ln(a + b) = \ln(a) + \ln(b)$
 - $\sin(2x) = 2 \sin(x)$
 - $\sqrt{x + y} = \sqrt{x} + \sqrt{y}$
- Solve for y and simplify as much as possible:

$$\frac{\frac{1}{y} + a}{\frac{1}{y} + b} = e^{-rt}$$

- Solve for y and simplify as much as possible:

$$\ln(x) - \ln(y) = -2 \ln(y) + ax + b$$

- Find all values of x for which $x^3 - 3x^2 + 2x$ equals zero.
- Find all values of x for which $x^3 + 2x^2 - x - 2$ equals zero.
- Using trigonometric identities, express $f(t) = \sqrt{2} \sin(3t) + \sqrt{2} \cos(3t)$ in the form $f(t) = A \sin(Bt + C)$, where A, B, C are real numbers.

0.2. Calculus and Integrals. Recommended review: You will need to know the basic rules of differentiation (product/quotient/chain rules) and be familiar with trigonometric, exponential and logarithmic functions. Stewart's Calculus, sections 3.1-3.5 and 7.1-7.5 might be helpful. We will be making heavy use of partial fractions in the second part of the course.

Here are some practice integrals.

1. $\int x e^{2x} dx$

2. $\int \ln(x) dx$

3. $\int \frac{2x^2 - x + 4}{x^3 + 4x} dx$

4. $\int \frac{dx}{\sqrt{x^2 - r^2}}$

5. $\int \frac{x - 9}{x^2 + 3x - 10} dx$

6. $\int \frac{x^2}{x + 1} dx$

7. $\int \frac{\sin(2\pi x)}{\sqrt{2 + \cos(2\pi x)}} dx$

8. $\int \frac{dx}{(x + 5)^2(x - 1)}$

9. $\int \frac{x - a}{x - b} dx$

10. $\int x \sin^{-1}(x) dx$