

Each problem is worth 10 points. For full credit provide good justification for your answers.

1. Evaluate

$$\int \frac{1}{x^2 + 4} dx$$

2. Evaluate

$$\int x e^x dx$$

3. Evaluate

$$\int \sqrt{4 - 2x} \, dx$$

4. Evaluate

$$\int \frac{5x + 1}{(2x + 1)(x - 1)} \, dx$$

5. Evaluate

$$\int \tan^7 \theta \sec^2 \theta d\theta$$

6. Evaluate

$$\int_2^{\infty} e^{-5t} dt$$

7. Biff is a Calculus student at Enormous State University, and he's having some trouble. Biff says "Dude, Calc is tough! I thought I was pretty good, but it's like you actually have to study this stuff or something! Unbelievable! So especially this trig sub stuff is killing me. I mean, how am I supposed to know when you do tan and when you do sin and stuff? Is it just magic?"

Help Biff out by explaining how to tell when to use which trig substitution.

8. It turns out there's a reason to care about $\int_0^r \sqrt{r^2 - x^2} dx$. Find the value of this integral.

9. Evaluate

$$\int_0^1 \tan^{-1} x \, dx$$

10. Derive Line 54 from the Table of Integrals,

$$\int u \sqrt{a + bu} \, du = \frac{2}{15b^2}(3bu - 2a)(a + bu)^{3/2} + C$$

Extra Credit [5 points possible]: For which values of p does

$$\int_1^{\infty} \frac{1}{x^p} dx$$

converge?