

Name: _____

Signature: _____

Show all work clearly and in order, and box your final answers. Justify your answers whenever possible. You have 20 minutes to take this 10 point quiz.

Do only one of the following two problems.

1. 10 points Evaluate.¹ You must show work!

$$\int_1^4 \sin \sqrt{x} \, dx$$

Solution: Taking the hint.

$$u = \sqrt{x} \quad \Rightarrow \quad du = \frac{1}{2\sqrt{x}} \, dx \quad \Rightarrow \quad du = \frac{1}{2u} \, dx \quad \Rightarrow \quad 2u \, du = dx$$

Here's goes.

$$\int_1^4 \sin \sqrt{x} \, dx = 2 \int_1^2 u \sin u \, du$$

Now here's the parts.

$$v = u \quad \Rightarrow \quad dv = du \quad \text{and} \quad \sin u \, du = dv \quad \Rightarrow \quad -\cos u = v$$

Here goes.

$$\begin{aligned} \int_1^4 \sin \sqrt{x} \, dx &= 2 \int_1^2 u \sin u \, du \\ &= -2u \cos u \Big|_1^2 + 2 \int_1^2 \cos u \, du \\ &= -2u \cos u + 2 \sin u \Big|_1^2 \\ &= \boxed{-4 \cos 2 + 2 \sin 2 + 2 \cos 1 - 2 \sin 1} \end{aligned}$$

¹First make a simple u -substitution where $u = \sqrt{x}$, then use integration by parts.

2. 10 points Integrate. You must show work!

$$\int_{-1}^1 \frac{2x^3 - 4x^2 - 15x + 5}{x^2 - 2x - 8} dx.$$

Solution: First you'll need to long divide.

$$\frac{2x^3 - 4x^2 - 15x + 5}{x^2 - 2x - 8} = 2x + \frac{x + 5}{x^2 - 2x - 8}.$$

Then use *partial fractions* to get

$$\frac{2x^3 - 4x^2 - 15x + 5}{x^2 - 2x - 8} = 2x + \frac{x + 5}{x^2 - 2x - 8} = 2x + \frac{3/2}{x - 4} - \frac{1/2}{x + 2}.$$

Now integrate.

$$\begin{aligned} \int_{-1}^1 \frac{2x^3 - 4x^2 - 15x + 5}{x^2 - 2x - 8} dx &= \int_{-1}^1 2x + \frac{3/2}{x - 4} - \frac{1/2}{x + 2} dx \\ &= \left. x^2 + \frac{3}{2} \ln|x - 4| - \frac{1}{2} \ln|x + 2| \right|_{-1}^1 \\ &= \boxed{\ln \frac{3}{5\sqrt{5}}} \end{aligned}$$