

Math 132 - Test 2

March 10, 2021

Name _____

Score _____

Show all work to receive full credit. Supply explanations where necessary. Unless otherwise indicated, evaluate all integrals by hand. (However, you may check your work with your calculator.)

1. (5 points) Use the definitions of the hyperbolic functions (in terms of exponential functions) to prove the following identity:

$$\cosh^2(x) + \sinh^2(x) = \cosh(2x)$$

2. (5 points) Use the identity above and the differentiation rules for the hyperbolic functions to derive an identity for $\sinh(2x)$.

3. (5 points) Using the definitions of the hyperbolic functions (in terms of exponential functions) and the quotient rule, show that $\frac{d}{dx}[\operatorname{csch} x] = -\operatorname{csch} x \coth x$.

4. (5 points) Let $f(x) = \tanh^{-1}(\cos(x))$. Use differentiation rules to find $f'(x)$.

5. (8 points) Evaluate the indefinite integral: $\int t \sin(t^2) \cos(t^2) dt$

6. (6 points) Use a substitution to evaluate the indefinite integral: $\int \frac{dx}{x(\ln x)^2}$

7. (10 points) Evaluate the definite integral: $\int_1^2 x^3 \ln x \, dx$

8. (8 points) Use integration by parts to evaluate the indefinite integral: $\int \sin x \cos x dx$

9. (12 points) Evaluate the definite integral: $\int_0^{\pi/2} x^2 \sin x dx$

10. (8 points) Evaluate the indefinite integral: $\int \tan x \sec^3 x \, dx$

11. (8 points) In the following integral, carry out the appropriate trigonometric substitution, simplify the integrand, and then stop. Do not evaluate the new integral.

$$\int \frac{dx}{\sqrt{1+9x^2}}$$

12. (8 points) Evaluate the indefinite integral: $\int 4 \cos^2 x \, dx$

13. (6 points) Use a product-to-sum formula to evaluate the definite integral: $\int_0^\pi \sin(3x) \sin(5x) \, dx$

14. (6 points) After making the trigonometric substitution $x = 4 \sin \theta$, you evaluated an integral and obtained $3\theta + \cos^2 \theta + C$. Resubstitute and write your result in terms of the variable x .