

ATTACH ALL WORK DONE NEATLY ON EXTRA PAPER. Find answers in simplest form (although fractions do not have to be rationalized). PLEASE BOX ANSWERS! Problems 1-11 are worth 2 points each. Problems 12-14 are worth 1 point per part.

1. Verify the identity:  $\frac{\tan x - \cot x}{\cos x + \sin x} = \sec x - \csc x$
2. Solve for  $x$ :  $2 \cos^3 x - \cos x = 0$  for  $0 \leq x < 2\pi$  (Don't forget that "canceling" generally sacrifices roots)
3. Solve for  $x$ :  $\sec(2x)\csc(2x) = 2\csc(2x)$  for  $0 \leq x < 2\pi$
4. Solve for  $x$  on the interval  $[0, 2\pi)$   $\cos 2x + 3\cos x + 2 = 0$
5. If  $\alpha$  and  $\beta$  are first quadrant angles so that  $\csc \alpha = \frac{5}{3}$  and  $\cos \beta = \frac{8}{17}$ , find  $\sec(\beta - \alpha)$
6. Find  $\tan\left(2\text{Arc sin}\frac{8}{17}\right)$
7. Find  $\sin\left(\text{Arc tan}\frac{1}{2} - \text{Arc cos}\left(-\frac{4}{5}\right)\right)$
8. Find  $\csc(\text{Arc tan } x)$
9. Find  $\cos(2\text{Arc tan } x)$
10. Determine an appropriate trigonometric substitution for  $x$  and express the following expression in **simplest** form:  $x^2\sqrt{4x^2 - 25}$
11. Determine an appropriate trigonometric substitution for  $x$  and express the following expression in **simplest** form:  $\frac{x^3}{\sqrt{49 - x^2}}$
12. Determine the valid value(s) of  $x$  in each of the following (**simplest** form!)
  - a.  $\ln 3x^2 = 5\ln 6 - 4\ln 10$
  - b.  $\ln x^5 = 4\ln 16 + 3\ln 8$
  - c.  $\ln(x+4) + \ln(x-2) = \ln(3x+4)$
  - d.  $3\ln x = \ln 3x$

13. Give the **simplest** form expression for each of the following. Assume all expressions are well-defined.

a.  $\ln e^{\sin x}$

b.  $e^{3\ln(x-2)}$

c.  $e^{\ln(\tan x)}$

d.  $e^{-\ln(x^2)}$

e.  $\ln\left(\frac{1}{e^{3x+4}}\right)$

14. Give the **simplest** form expression for each of the following. Assume all expressions are well-defined.

a.  $e^{3x} \cdot e^{5x}$

b.  $e^x + e^x$

c.  $\left(e^{3x^4}\right)^2$

d.  $e^{4-2\ln x}$