

1. (16 pts) Find the exact value of the following expression.

a) $2\ln \sqrt{e} + 2^{\log_2 4} + \log_2[16]$

b) $\log_3 135 - \log_3 45$

c) $\log_2[e^{\ln 8}]$

d) $2[\cos(45^\circ)]^2 + 2[\sin(45^\circ)]^2 - 2 \tan(45^\circ)$

2. (6 pts) Given that $\cos \theta = \frac{2}{5}$, where θ is an acute angle, find the exact values of the 5 other trigonometric functions. (*Rationalize any and all denominators*).

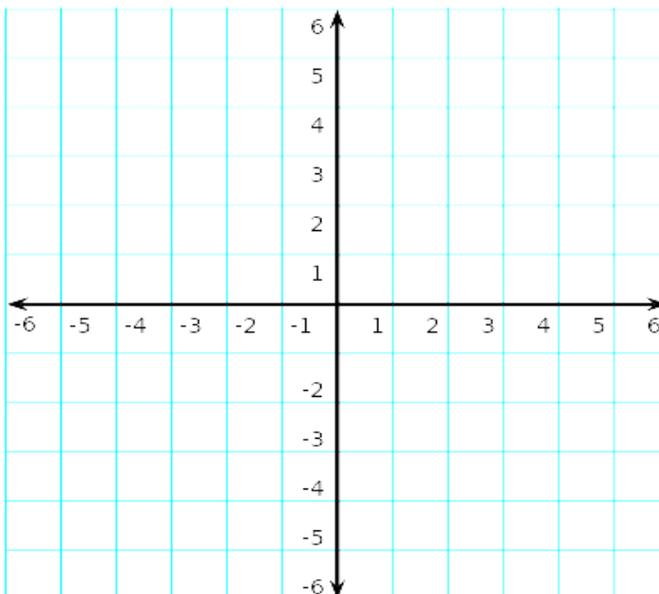
3. a) (4 pts) Write the expression in condensed (compressed) form with a coefficient of 1. (*Assume all variables represent positive numbers*)

$$\frac{1}{3}\log(x + 2)^3 + \frac{1}{2}[\log(x^4) - \log(x^2 - x - 6)^2]$$

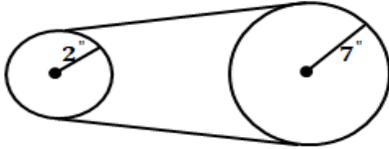
- b) (4 pts) Write the expression in expanded form. (*Assume all variables represent positive numbers*)

$$\log \sqrt{100x\sqrt{y}}$$

4. (10 pts) Graph the function $y = -2^{x+2} - 1$, on the set of axes below by making a table of values or using transformation. Be sure to label the asymptote on the graph, if any exists.



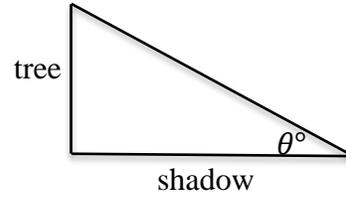
5. Given the 2 in. radius wheel and 7 in. radius wheel pulley system as shown below, find the following. (*You Can't Use Ratios*).



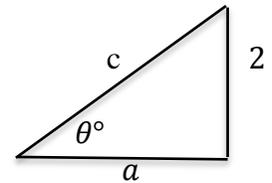
- a) (5 pts) If the 2 in. radius wheel turns through an angle of 50° , what angle (expressed in degrees) does the 7 in. radius wheel turn through.

- b) (5 pts) If the 2 in. radius wheel is spinning at a rate of 6 rpms, how many rpms is the 7 in. radius wheel making?

6. a) (5 pts) Find the height of a tree that casts a 100-foot shadow on the ground if θ (the angle of elevation) to the sun from the ground is 45° as shown in the diagram below



- b) (5 pts) Given the right triangle as labeled below, if $\sin \theta = \frac{1}{4}$, find the lengths of side 'a' and 'c'. *Simplify your answers as much as possible.*



7. (20 pts) Solve the following equation for all real solutions. Make sure all answers are in the domain of the original problem.

a) $\log_6(x + 2) + \log_6(x - 3) = 1$

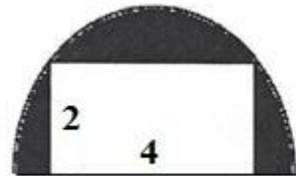
b) $3xe^x + x^2e^x = 0$

c) $4(2^{6-2x}) - 5 = 27$

d) $\log(x^2 + 1) = \log(x - 2) + \log(x + 3)$

8. a) (5 pts) Suppose that $\cos \theta = \frac{1}{x}$ where 'x' is a nonzero constant. Find the values of the other 5 trigonometric functions in terms of 'x'. (*You do not need to rationalize the denominator*)

- b) (5 pts) Given the rectangle (4 feet by 2 feet) inscribed in the semicircle as shown below, find the area of the shaded region of the semicircle.



9. a) (4 pts) Given that $f(x) = 5^x + 5^{-x}$ and $g(x) = 5^x - 5^{-x}$, evaluate the following expression below.

Fully simplify your answer.

$$[f(x)]^2 + [g(x)]^2$$

b) (3 pts) Simplify completely (*give your answer with positive exponents only*)

$$\left[\frac{(-x^2y)^3 y^{-4}}{(xy)^5} \right]^{-2}$$

c) (3 pts) Simplify completely.

$$\frac{\sqrt{16-16x^2}}{4-4x}$$