Math 418: Worksheet 9

November 9, 2020

1 Solve the following equations. If no solution exists write "No Solution".

a) $\log_3(2-x)+\log_3(10-x)=1$

b) $2+\log\sqrt{1+x}+3\log\sqrt{1-x}=\log\sqrt{1-x^2}$

c) $\ln(\ln(-w))=-1$

d) $\frac{2^x-2^{-x}}{2^x+2^{-x}}=4$

e) $(\log_2(x))^2-\log_2(x^2)=3$

f) $\frac{\ln(3x^4)}{\ln(2x)}=2$

2 Suppose $\log_6 a=3.1$ and $\log_6 b=4.2$. Evaluate the expressions below:

a) $\log_6\left(\frac{b}{a}\right)$

b) $\log_6(a^3)$

c) $\log_6(a^2b^5)$

d) $\frac{a}{b}$

e) $\log_{36} b$

3 In astrophysics the **apparent magnitude** of a star (or other celestial body) is a measure of how bright the object appears from the Earth's location in space. The apparent magnitude scale is designed in such a way that an object having an apparent magnitude five higher than another object is 100 times less bright than the other star. Thus a higher apparent magnitude appears to be less bright than an object with a lower apparent magnitude. This is a reverse **logarithmic** scale. Answer the following questions.

a) How much brighter is a star with apparent magnitude 1.0 than a star with apparent magnitude 2.0? Hint: the answer is NOT 20.

b) Suppose the difference in apparent magnitudes of two stars is x. How many times brighter is the brighter star than the dimmer star?

c) A certain Gamma Ray Burst had an apparent magnitude of (approximately) -68 and our star (the Sun) has an apparent magnitude of (approximately) 27. How many times brighter than the Sun was the Gamma Ray Burst?

d) Venus has a minimum apparent magnitude of (approximately) -5 (when it is as close as possible to the Earth) and a maximum apparent magnitude of (approximately) -3 (when it is as far as possible from the earth). How many times brighter is it when it is closer than when it is further?

4 Find all values for t so that the point $\left(\frac{2}{3}, t\right)$ lies on the unit circle.

5 Find all values for p so that the point $(2p, p)$ lies on the unit circle.

6 Find all values for t so that the point $\left(3t, \frac{-3}{5}\right)$ lies on the unit circle.

7 Find all points that lie on the unit circle and the parabola $y = x^2$.

8 Find all points that lie on the unit circle and the line $y = -4x$