

Instructions:

PLEASE PROVIDE STEP BY STEP EXPLANATIONS
ANSWERS WITHOUT EXPLANATION
MAY NOT GET FULL CREDIT

Time Limit 2 hours

Please read the questions carefully before answering
Each problem 15 points unless otherwise stated.

1. (MANDATORY PROBLEM) (20 points)

(a) Write $\ln \left(\frac{x^{\frac{1}{5}}(x-4)^5}{(x^5+7)^2} \right)$ as a sum or difference of the logarithms of x , $x - 4$ and $x^5 + 7$.

(b) If $\log_2 3 = a$, $\log_2 5 = b$, $\log_2 7 = c$, write the following in terms of a, b, c : (i) $\log_2 \frac{35}{2}$ (ii) $\log_2 105$

ANSWER ANY 12 OUT OF THE FOLLOWING 17

2. (i) Solve the exponential equation $(\frac{1}{3})^x = 15$.

(ii) Solve the logarithmic equation $\log_3(x^2 + 1) = 2$.

3. The half-life of Silicon-32 is 710 years. If 30 grams is present now, how much will be present in 300 years? (Round your answer to three decimal places. You MUST explain how you obtained your answer).

4. If Emory has \$1000 to invest at 11 percent per year compounded monthly, how long will it take before he has \$1200? If the compounding is continuous, how long will it be? (Round answer to 3 decimal places).

5. Given that $\operatorname{cosec} \theta = -3$ and that $\tan \theta$ is negative, find the exact values of $\sin \theta$, $\cos \theta$, $\sec \theta$, and $\cot \theta$. Do not use calculator. You must explain the steps and indicate the formula that you are using.

6. Graph $y = 5\sin(4x + 2\pi)$ showing clearly the amplitude, two full periods, x -intercepts and y -intercept.

7. Find the exact value of $\frac{\sec(475^\circ)}{\operatorname{cosec}(65^\circ)}$. Do not use calculator ; You must explain the steps and indicate the formula that you are using.

8. Find $\cos(\sin^{-1}(3/5) + \cos^{-1}(1/3))$. Do not use calculator. You must explain the steps and indicate the formula that you are using.

9. [Do not use calculator for this problem; You must explain the steps and indicate the formula that you are using.] Find the exact value of $\cos 75^\circ$ in two ways: (i) using the value of $\cos 150^\circ$ (ii) expanding $\cos(45^\circ + 30^\circ)$.

10. Prove the identity $1 + \tan^2 \theta = \sec^2 \theta$.

11. Find exactly all the values of θ for which $\operatorname{cosec}^2 \theta = 2$. Do not use calculator. You must explain the steps and indicate the formula that you are using.

12. Find all of the angles of a triangle if its sides are 7, 24 and 25.

13. A 6 foot tall man stands 20 feet from a wall with a large window. The angle of elevation to the bottom of the window is 30° and the angle of elevation to the top of the window is 45° . What is the height of the window? What is the height of the bottom of the window above the ground?

14. Solve the following system of equations using matrices (row operations). If the system has no solution, say that it is inconsistent.

$$8x - y + 4z = 40$$

$$8x + 4z = 44$$

$$2y + z = 17$$

15. A twin-engined aircraft can fly 1400 miles from city A to city B in 5 hours with the wind and make the return trip in 7 hours against the wind. What is the speed of the wind?

16. Graph the following system of inequalities. Indicate the solution by shading.

$$2x + 3y \geq 6$$

$$x - y \leq 3$$

$$y \geq 2$$

17. Find the lengths of h and x in the following diagram.

18. Find the length of x in the following diagram.

Figure 2

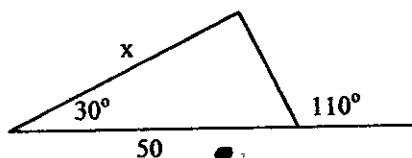
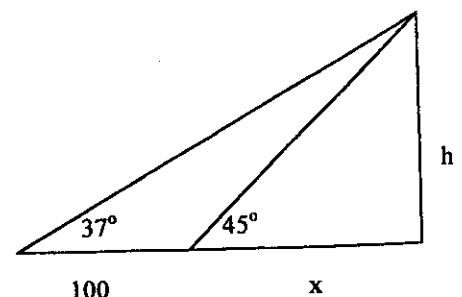


Figure 1



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17