MATH 121 Sample Final Exam

1. (20 pts) Without using your calculator, find all solutions to $|5x-3| = 4x+2$. You must show all of your work. You may use your calculator to confirm your answer.

2. (20 pts) A ball is thrown up from a height of 5 feet with an initial velocity of 30 feet per second. The height of the ball above the ground (in feet) after t seconds is given by:

$$h(t) = -16t^2 + 30t + 5$$

When does the ball reach the ground? Solve the problem algebraically and round the answer to two decimal places. You may use your calculator to confirm your answer.

3. (20 pts) Find all roots, real and complex, of $x^3 - 3x^2 + 5x - 3 = 0$. Your must show your work to receive full credit.

4. (20 pts) The formula $A = Pe^{rt}$ is used to compute investment growth that is compounded continuously. Answer the following questions, assuming that the annual interest rate is $r = 6.25\%$.

   (a) If $\$15,000$ is invested originally, how much money will there be in five years?

   (b) How long will it take an initial investment of $\$15,000$ to grow to $\$20,000$?

   (c) How long will it take for an investment to triple in value?

5. (20 pts) Find, EXACTLY, all solutions to the equation $2\cos(3x) = 1$.

6. (20 pts) Standing 75 feet from a building, a surveyor measures the angle of elevation from the ground level to the top of the building to be 63°, how tall is the building? Include a sketch of the situation in your answer.

7. (20 pts) Let $z = 1 - \sqrt{3}\, i$.

   (a) Write z in polar form.

   (b) Write z^{13} in the form $a + bi$.

8. (20 pts) In the triangle below the side AC is 12 meters, the side CB is 6 meters, and the angle at C is 100°. What is the length of side AB? What is the angle at A?

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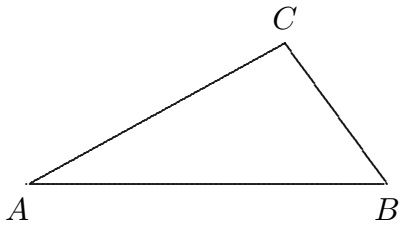
(NOTE: the picture is NOT drawn to scale.)



9. (20 pts) Which of the following equations are identities? Circle **T**(RUE) or **F**(ALSE) and give a counterexample for each FALSE answer.

T - F $\sin(x+\pi) = -\sin x$

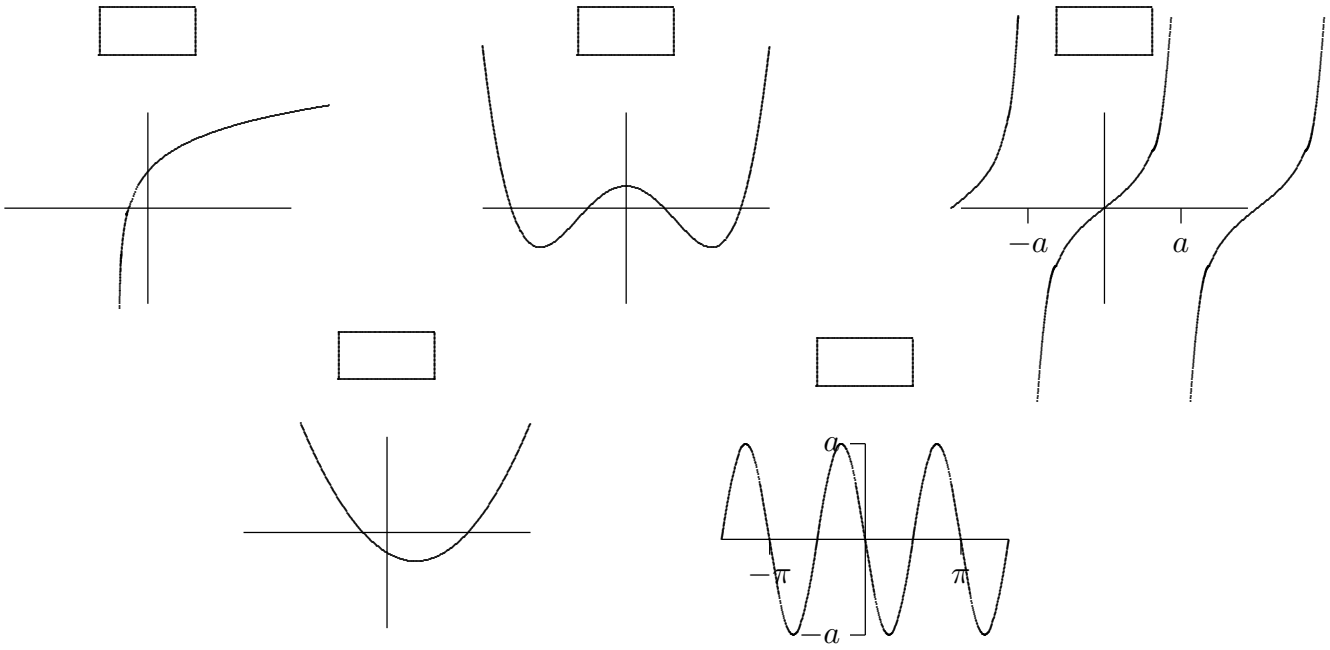
T - F $(1+\tan x)^2 = \sec^2 x$

T - F $\log(x+y) = \log(x) + \log(y),\ x>0, y>0$

T - F $\ln(x^3) = 3\ln(x),\ x>0$

T - F $\tan(x+\pi) = \tan(x)$

10. (20 pts) In the box above each of the graphs below, write the letter that corresponds to the equation which best fits that graph.



EQUATIONS:

(A) $y = \tan(\pi a x)$ (B) $y = \tan(\frac{1}{a}x)$ (C) $y = \tan(\frac{\pi}{2a}x)$

(D) $y = -a\sin(2x)$ (E) $y = -a\sin(\frac{1}{2}x)$ (F) $y = a\sin(2x)$

(G) $y = (x^2-a^2)(x^2-b^2)$ (H) $y = (x-a)^3(x-b)$ (I) $y = -x^4 + ax^3 + bx^2 + c$

(J) $y = (x-a)^2 + a,\ a>0$ (K) $y = (x+a)^2 - a,\ a>0$ (L) $y = 2(x-a)^2 - a,\ a>0$

(M) $y = e^{ax},\ a>0$ (N) $y = \ln(x-a),\ a>0$ (O) $y = \ln(x+a),\ a>0$

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