MAT 1800 Final Exam
SHOW ALL WORK IN A BLUEBOOK:
Only minimal credit will be awarded for answers without supporting work.
Each problem is worth 10 points.

#1. Solve: \( \frac{3}{x-1} - \frac{4}{x} \geq 1 \)

#2. Find the domain of the function: \( f(x) = \sqrt[4]{x^2 - 6x} \)

#3. Given that \( f(x) = x^4 - 1 \), \( g(x) = \sqrt{1+x} \) and \( h(x) = \sqrt{x} \).

Find the following and simplify: a) \( g \circ f(x) \) b) \( f \circ h(x) \)

#4. Among all rectangles that have a perimeter of 20 feet, find the dimensions of the one with the largest area.

#5. Find the average rate of change of the function \( f(x) = \frac{x}{x+1} \) between the values \( x = t \) and \( x = t + a \).

#6. Find all the real and complex zeros of the polynomial \( P(x) = x^4 - 2x^3 - 2x^2 - 2x - 3 \).

#7. Graph \( f(x) = \frac{x^2 - x - 6}{x^2 + 3x} \) labeling all intercepts and asymptotes.

#8. Graph \( f(x) = \frac{x^2 - 4x - 5}{x - 3} \) labeling all intercepts and asymptotes.

#9. Graph \( f(x) = \log_3 (x-1) - 2 \) labeling all intercepts and asymptotes.

#10. Simplify: a) \( 3^{2 \log_3 4 + \log_3 10} \) b) \( e^{2\ln 7} + 3e^{\ln 4} \)

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#11. Given the approximate values: $\log_{10}(2) = 0.3$ and $\log_{10}(3) = 0.47$

Find a) $\log_{10}(5)$ b) $\log_{10}(90)$

#12. Solve: $\log_5(x+1) - \log_5(x-1) = 2$

#13. Solve: $e^{2x} - e^x - 6 = 0$

#14. The number $N$ of bacteria in a culture is modeled by the function $N(t) = 25e^{kt}$, where $t$ is measured in hours. If there are 200 bacteria after 3 hours, find the exact time required for there to be 300 bacteria.

#15. Find the values: a) $\sec\left(\frac{11\pi}{4}\right)$ b) $\tan\left(-\frac{7\pi}{6}\right)$

#16. Graph $f(x) = 5\cos\left(3x - \frac{\pi}{4}\right)$ labeling the highest and lowest points.

#17. Given that $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$ and $\csc \theta = -5$ find the value of: $\cos\left(\theta - \frac{\pi}{6}\right)$

#18. Solve for $x$: $2\sin x \tan x - \tan x = 1 - 2\sin x$ where $0 \leq x < 2\pi$

#19. Find the values: a) $\tan\left(\cos^{-1}\left(-\frac{3}{4}\right)\right)$ b) $\cos^{-1}\left(\cos\left(\frac{5\pi}{4}\right)\right)$

#20. Prove the identity: $\frac{2(\tan \theta - \cot \theta)}{\tan^2 \theta - \cot^2 \theta} = \sin 2\theta$