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Show all work to receive full credit. Supply explanations where necessary.

1. (8 points) Evaluate the limit: $\lim _{x \rightarrow 3^{+}}\left(\frac{18}{x^{2}-9}-\frac{x}{x-3}\right)$
2. (8 points) Explain why the integral $\int_{0}^{\infty} \frac{3}{16+x^{2}} d x$ is improper. Write it as a limit of proper integrals and evaluate.
3. (8 points) Integrate: $\int 5 \sec ^{6} 8 y \tan 8 y d y$
4. (10 points) Integrate: $\int_{0}^{1 / 2} \cos ^{-1} x d x$.
5. (12 points) Integrate: $\int \frac{2 x^{3}-4 x^{2}-15 x+5}{x^{2}-2 x-8} d x$.
6. (10 points) Integrate: $\int \sqrt{25-4 x^{2}} d x$.
7. (8 points) Evaluate the limit: $\lim _{x \rightarrow-\infty} x^{2} e^{x}$
8. (8 points) Use a product-to-sum formula to evaluate the following integral.

$$
\int \cos (3 x) \cos (7 x) d x
$$

9. (8 points) Integrate: $\int x^{3} \sin 2 x d x$
10. (3 points) Explain why the integral is improper: $\int_{-1}^{4} \frac{1}{x^{3}} d x$
11. (4 points) Write the form of the partial fraction decomposition of $\frac{x}{x^{3}\left(x^{2}+9\right)^{2}(2 x+1)}$. Do not solve for the undetermined coefficients.
12. (5 points) After making the trigonometric substitution $x=6 \sec \theta$, you evaluated an integral and obtained $\theta+\cot \theta+C$. Resubstitute and write your result in terms of the variable $x$.
13. (8 points) (Take-home problem)

A large vertical dam in the shape of an isosceles trapezoid has a height of 30 m , a width of 20 m at its base, and a width of 40 m at the top. What is the total fluid force on the face of the dam when the reservoir is full? (Assume the water weighs $9807 \mathrm{~N} / \mathrm{m}^{3}$.)

