Name: ______________________________

4-digit code: ______________________________

- Write your name and the last 4 digits of your SSN in the space provided above.
- The test has five (5) pages, including this one.
- Enter your answer in the box(es) provided.
- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given in parentheses at the right of the problem number.
- No books, notes or calculators may be used on this test.

Page	**Max. points**	**Your points**
2	30	
3	30	
4	20	
5	20	
Total	100	

Problem 1 (30 pts). Evaluate each integral:

(a) $\displaystyle\int \left(3\sin x - 2\sec^2 x\right) dx$

(b) $\displaystyle\int \frac{5x^4}{(x^5+1)^2}\, dx$

(c) $\displaystyle\int_0^1 (5x-3)\, dx$

Problem 2 (20 pts)**.** Express the following functions of n in closed form and then find the limit.

(a) $\lim_{n\to\infty} \dfrac{1^2+2^2+3^2+\cdots+n^2}{n^3}$

(b) $\lim_{n\to\infty} \sum_{k=1}^{n} \dfrac{5k}{n^2}$

Problem 3 (10 pts)**.** Use the definition of **definite integral** to express $\int_{-\pi/2}^{\pi/2}(1+\cos x)\,dx$ as a limit.

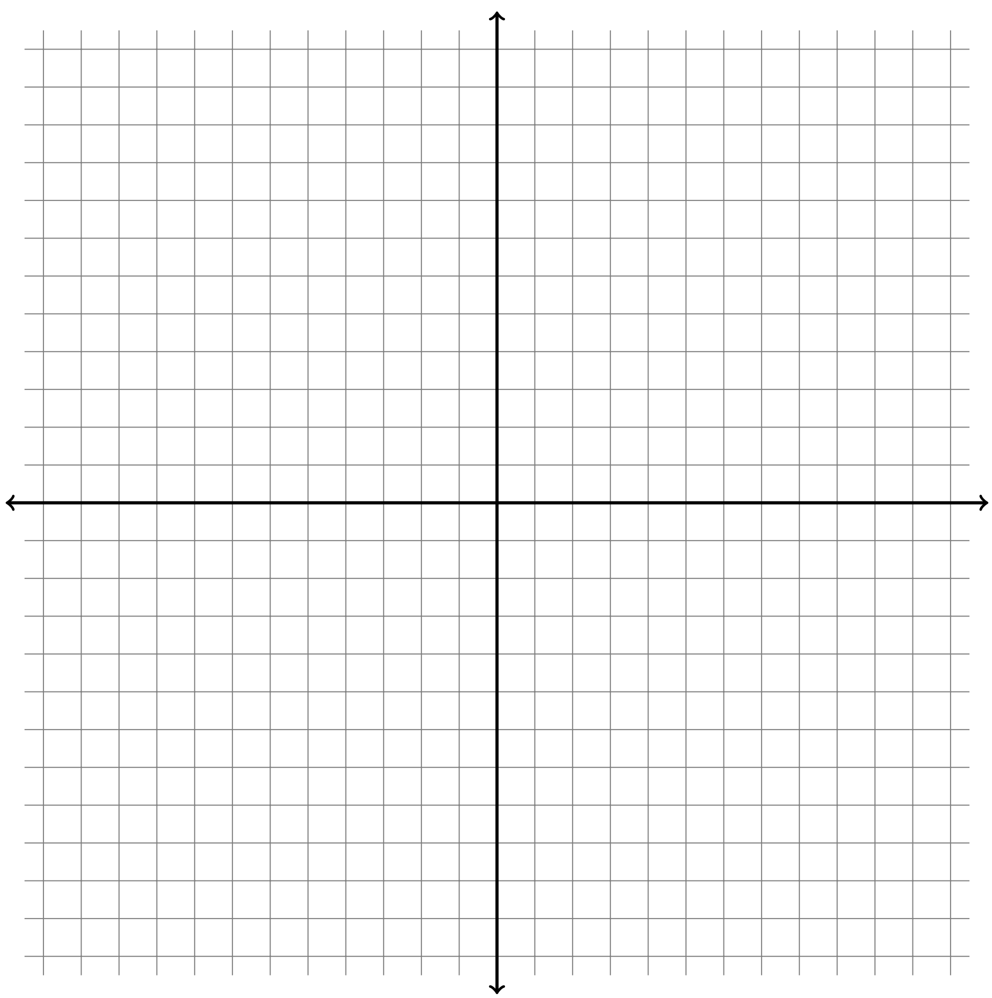
Problem 4 (20 pts)**.** Sketch the graph of the rational function $f(x) = \dfrac{2x^2 - 8}{x^2 - 16}$.

Use the back of this page for computations and sign-charts. Indicate clearly:

- Domain
- x- and y-intercepts.
- Vertical and horizontal asymptotes (any holes?).
- Intervals of increase, decrease and different concavity.
- Location of relative extrema and inflection points.

HINT: The first and second derivatives are, respectively

$$f'(x) = \frac{-48x}{(x^2 - 16)^2}, \quad f''(x) = 48\frac{3x^2 + 16}{(x^2 - 16)^3}$$



Problem 5 (10 pts)**.** Use the Fundamental Theorem of Calculus to find the derivative of the following functions.

(a) $g(x) = \displaystyle\int_1^x \frac{1}{t^3+1}\,dt$

$g'(x) = \boxed{}$

(b) $g(y) = \displaystyle\int_x^\pi \sqrt{1+\sec t}\,dt$

$g'(y) = \boxed{}$

Problem 6 (10 pts)**.** Find the antiderivative F of $f(x) = 4 - 3(1+x^2)^{-1}$ that satisfies $F(1) = 0$.
HINT: You need to use the constant of integration.

$F(x) = \boxed{}$