

HOMEWORK 3 - MATH 152

DUE DATE: Monday, October 4

INSTRUCTOR: George Voutsadakis

Read each problem very carefully before starting to solve it. One part of each homework problem will be chosen at random and graded. Each question is worth 1 point. It is necessary to show your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Assume that a force of 6N is required to compress a spring from a natural length of 4m to a length of $3\frac{1}{2}$ m. Find the work required to compress the spring from its natural length to a length of 2m.
2. A swimming pool is built in the shape of a rectangular parallelepiped 10 ft deep, 15 ft wide and 20 ft long. How much work is required to fill in the swimming pool 1 ft from the top if the water is pumped in through an opening located at the bottom of the pool?
3. An oil tank is shaped like a right cylinder of diameter 4ft. Find the total fluid force against one end when the axis is horizontal and the tank is half filled with oil of weight density 50lb/ft³.
4. An observation window on a submarine is a square with 2ft sides. Using ρ_0 for the weight density of sea water, find the fluid force on the window when the submarine has descended so that the window is vertical and its top is at a depth of h feet.
5. Find $\frac{dy}{dx}$:
 - (a) $y = \cosh(x^4)$
 - (b) $y = \sinh^3(2x)$
 - (c) $y = \cosh^{-1}(\sinh^{-1}x)$
 - (d) $y = \sinh^{-1}(\tanh x)$
6. Evaluate the integrals
 - (a) $\int \sqrt{\tanh x} \operatorname{sech}^2 x dx$
 - (b) $\int \operatorname{csch}^2(3x) dx$
 - (c) $\int \frac{dx}{\sqrt{1+9x^2}}$
 - (d) $\int \frac{dx}{\sqrt{9x^2-25}}$
7. Find the limits $\lim_{x \rightarrow +\infty} (\cosh^{-1} x - \ln x)$ and $\lim_{x \rightarrow +\infty} \frac{\cosh x}{e^x}$.
8. Evaluate the integrals
 - (a) $\int \ln(x^2 + 4) dx$
 - (b) $\int e^x \sin x dx$
 - (c) $\int_0^2 x e^{2x} dx$