

Math 190 Homework 11 (not to be handed in)

This homework is not for marks. It is intended to give practise with integration by parts and integral word problems.

Questions:

1. Compute the following integrals

- $\int x e^x dx$
- $\int x \sin x dx$
- $\int x^2 \cos x dx$
- $\int (x + 3) e^{-x} dx$
- $\int x \sin(2x) dx$
- $\int x \cos(3x + \pi) dx$
- $\int x \ln x dx$
- $\int \frac{\ln x}{x^2} dx$
- $\int x \ln(1 + x) dx$
- $\int \ln x dx$
- $\int (\ln x)^2 dx$
- $\int e^x \cos x dx$
- $\int \cos x \ln(\sin x) dx$

2. Compute the following definite integrals

- $\int_{\ln 2}^{\ln 3} x e^x dx$
- $\int_0^{\pi/2} x \sin x dx$
- $\int_1^2 \frac{\ln x}{x^2} dx$

3. An oil storage tank ruptures at time $t = 0$ and oil leaks from the tank at a rate of

$$r(t) = 100e^{-0.01t}$$

liters per minute. How much oil leaks out during the first hour?

4. The velocity of a particle is given by

$$v(t) = 2 \cos(\pi t) + t$$

in centimetres per second after t seconds. If the particle starts 10 cm away from you, how far away is the particle after 1.5 seconds.

5. A ball is thrown upward with speed 2 m/s. Assume the acceleration due to gravity is constant. That is

$$a(t) = -g$$

in units of m/s^2 . Find the time when the ball turns around and starts to fall back down (ie. the time when $v(t) = 0$).

6. You are driving on the highway with a velocity of 100km/h. You see someone selling ice cream 100m ahead and slam on the breaks. You accelerate at a constant (negative) rate of

$$a(t) = -50000 \text{ km/h}^2.$$

How long before you stop? Do you stop in time?