Math 101 – WORKSHEET 5
INDEFINITE INTEGRALS

Theorem (Net change)**.** *Suppose f' is continuous. Then* $\int_a^b f'(t)\,\mathrm{d}t = f(b) - f(a)$.

(1) (Net change theorem)

(a) A particle moves with velocity $v(t) = \pi \sin(\pi t)$. What is its displacement between the times $t = 0$ and $t = 2$?

(b) What is the total distance covered by the particle?

(c) According to Newton's law of universal gravitation, the gravitational acceleration at distance r from a star of mass M is $a(r) = -\frac{GM}{r^2}$. The *gravitational potential* $\phi(r)$ is defined by $\phi'(r) = -a(r)$. What is the change in the gravitational potential between the surface of the Earth ($R_1 \approx 6,400\text{km}$) and geostational orbit ($R_2 \approx 42,000\text{km}$)? You may use $M_{\text{earth}} \approx 6 \cdot 10^{24}\text{kg}$ and $G \approx 6.7 \cdot 10^{-11}\text{m}^3/(\text{kg} \cdot \text{s}^2)$.

Date: 13/1/2016, Worksheet by Lior Silberman.

(2) Find the indefinite integrals

(a) For $n \neq -1$, $\int x^n \, \mathrm{d}x =$

(b) $\int \left(\frac{1}{2}x^{3/2} - e^{-x/3} + 7\right) \mathrm{d}x =$

(c) $\int_4^9 \left(x^{5/2} + e^{2x}\right) \mathrm{d}x =$

(d) $\int x \left(e^{x^2} + 1\right) \mathrm{d}x =$