

MATH110 — Assignment 8

Solutions

Question 1.

(a)

$$\int (x^3 + 3x^2 + 2/x)dx = \int x^3 dx + 3 \int x^2 dx + 2 \int x^{-1} dx = \frac{1}{4}x^4 + x^3 + 2 \ln x + c.$$

(b)

$$\int x^{\frac{1}{3}} dx = \frac{3}{4}x^{\frac{4}{3}} + c.$$

(c)

$$\int \sin(x/3) dx = -3 \cos(x/3) + c.$$

(d)

$$\int e^{-2x} dx = -\frac{1}{2}e^{-2x} + c.$$

Question 2.

Let $s(t)$ be the height of the rocket after t seconds. Now

$$s'(t) = v(t) = t + \frac{\sqrt{t}}{80}$$

and

$$\begin{aligned} s(t) &= \int v(t) dt = \int \left(t + \frac{\sqrt{t}}{80} \right) dt \\ &= \frac{1}{2}t^2 + \frac{1}{120}t^{\frac{3}{2}} + c \end{aligned}$$

The condition $s(0) = 0$ shows that $c = 0$ and the height after one minute is

$$s(60) = \frac{1}{2}60^2 + \frac{1}{120}60^{\frac{3}{2}} = 1803.9m.$$

Question 3.

(a)

$$\int_1^2 (x^2 + x^{-1} + 1) dx = \left[\frac{1}{3}x^3 + \ln(x) + x \right]_1^2 = \left[\frac{8}{3} + \ln(2) + 2 \right] - \left[\frac{1}{3} + 0 + 1 \right] = \frac{10}{3} + \ln(2).$$

(b)

$$\int_0^{\pi/2} \sin x dx = [-\cos x]_0^{\pi/2} = -\cos(\pi/2) + \cos(0) = 1.$$

(c)

$$\int_0^1 e^{2x} dx = \left[\frac{1}{2}e^{2x} \right]_0^1 = \frac{1}{2}e^2 - \frac{1}{2}e^0 = \frac{1}{2}(e^2 - 1) = 3.19(\text{approx}).$$