Question 1:

(a) A car travelling at 30 m/s applies the brakes and accelerates at $a(t) = -10t - 5$ m/s^2, where $t = 0$ corresponds to the instant the brakes are applied (notice the acceleration is negative since the car is slowing down.) How long does it take the car to come to a stop?

[5]

(b) Find $f(x)$ if

$$f''(x) = 28\sqrt[3]{x} + \sin(x), \quad f'(0) = 1, \quad f(0) = \pi$$

[5]

Question 2: Determine the following:

(a) $\displaystyle\int x(x^2 - 3)\,dx$

[2]

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

[2]

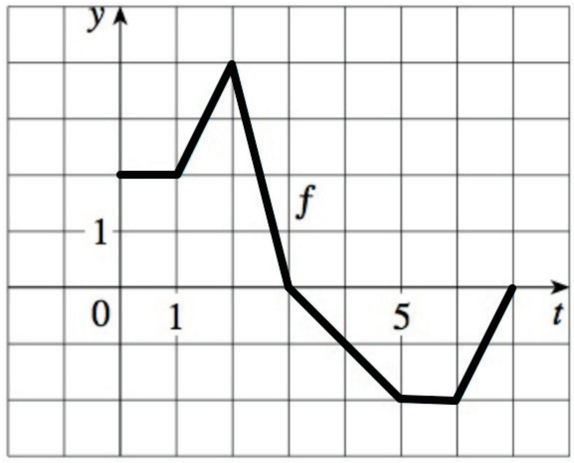
(c) $\displaystyle\int_0^{\pi} 2\sin(x) - \frac{\cos(x)}{3}\,dx$

[3]

(d) $\displaystyle\int_0^{3} |3x - 6|\,dx$

[3]

Question 3: The graph of $y = f(t)$ below represents the outside temperature over a seven hour period of a January day. What was the average temperature over the seven hours?



[5]

Question 4: An ant colony of size 100 grows over time according at a rate given by $\dfrac{100t^2}{1+t^3}$ ants per week, where $t = 0$ corresponds to the present. What will be the ant colony size in two weeks time?

[5]

Question 5: Determine the following:

(a) $\int x(1-x^2)^{1/2}\,dx$

[2]

(b) $\int \sec^2(3x+2)\,dx$

[2]

(c) $\int \frac{e^x}{(5-3e^x)}\,dx$

[3]

(d) $\int x^3\sqrt{x^2+1}\,dx$ (Hint: $x^3 = x \cdot x^2$)

[3]

Question 6: Determine the following:

(a) $\displaystyle\int_0^1 \frac{10\sqrt{x}}{(1+x^{3/2})^2}\,dx$

[3]

(b) $\displaystyle\int_0^\pi \frac{\sin(t)}{2-\cos(t)}\,dt$

[3]

(c) $\displaystyle\int_e^{e^2} \frac{1}{x[\ln(x)]^3}\,dx$

[4]