hw set 17
sect 6.4
p 469

2. $g(x) = x^2\sqrt{1+x^3}\ , [0,2]$

$$f_{AVG} = \frac{1}{2-0}\int_0^2 x^2\sqrt{1+x^3}\,dx \qquad u = 1+x^3 \quad du = 3x^2dx$$

$$= \frac{1}{2}\int \frac{1}{3}\sqrt{u}\,du = \frac{1}{6}\cdot\frac{2}{3}u^{3/2} = \frac{1}{9}u^{3/2}$$

$$= \frac{1}{9}(1+x^3)^{3/2}\Big|_0^2 = \frac{27}{9} - \frac{1}{9} = \frac{26}{9} = 2.\overline{8}$$

3. $f(t) = te^{t/2}\ , [0,3]$

$$f_{AVG} = \frac{1}{3-0}\int_0^3 te^{t/2}\,dt \qquad u=t \quad du = 1dt \quad dv = e^{t/2} \quad v = 2e^{t/2}$$

$$= \frac{1}{3}\left[2te^{t/2} - \int 2e^{t/2}\right]$$

$$= \frac{2}{3}te^{t/2} - \frac{4}{3}e^{t/2}\Big|_0^3$$

$$= (2e^{3/2} - 4/3\,e^{3/2}) - (-4/3) = \frac{2}{3}e^{3/2} + 4/3$$

$$= 4.321126$$

5. $f(x) = (x-3)^2\ , [2,5]$

a) $$f_{AVG} = \frac{1}{5-2}\int_2^5 x^2-6x+9\,dx$$

$$= \frac{1}{3}\left[\frac{x^3}{3} - 3x^2 + 9x\right]_2^5 = \frac{1}{3}\left[11\tfrac{2}{3} - 8\tfrac{2}{3}\right] = 1$$

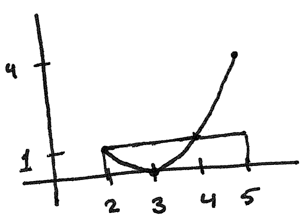
b) $f_{AVG} = f(c)\ , c = ?$

$f(c) = (c-3)^2 = 1$

$c-3 = \pm 1$

$c = 4$ or 2

c)



10. $f(x) = 2+6x-3x^2\ , [0,b]\ , f_{AVG} = 3$

$$f_{AVG} = 3 = \frac{1}{b-0}\int_0^b 2+6x-3x^2\,dx$$

$$3 = \frac{1}{b}\left[2x+3x^2-x^3\right]_0^b$$

$$3 = \frac{1}{b}(2b+3b^2-b^3)$$

$$3 = 2+3b-b^2$$

$$b^2-3b+1 = 0$$

$$b = \frac{3\pm\sqrt{9-4(1)(1)}}{2} = \frac{3\pm\sqrt{5}}{2}$$

$$= 2.618\ ,\ .381966$$

14. $T(t) = 20+75e^{-t/50}\ , [0,30]$

$$\text{Avg temp} = \frac{1}{30-0}\int_0^{30} 20+75e^{-t/50}\,dt$$

$$= \frac{1}{30}\left[20t - 3750e^{-t/50}\right]_0^{30}$$

$$= \left[20 - 125e^{-3/5}\right] - \left[0-125\right]$$

$$= 145 - 125e^{-3/5}$$

$$\approx 76.3985455$$

EC

15. a) $E(t) = 155\sin(120\pi t)\ , t = \text{sec}$

1 cycle $= \frac{1}{60}$ sec

$$\text{RMS} = \left[\frac{1}{1/60-0}\int_0^{1/60}(E(t))^2\,dt\right]^{1/2}$$

$$= \left(60\int_0^{1/60}(155\sin(120\pi t))^2\,dt\right)^{1/2}$$

$$= \left[60\cdot\frac{4805}{24}\right]^{1/2} = \frac{155}{\sqrt{2}}$$

$(= 110\text{ V})$

b) $E(t) = A\sin(120\pi t)\ , \text{RMS} = 220$

$$220 = \left[60\int_0^{1/60}(A\sin(120\pi t))^2\,dt\right]^{1/2}$$

$$\frac{220^2}{60} = \int_0^{1/60}A^2\sin^2(120\pi t)\,dt$$

$$\frac{220^2}{60} = A^2\int_0^{1/60}\sin^2(120\pi t)\,dt$$

$$\frac{220^2}{60} = A^2\cdot\frac{1}{120}$$

$$2\cdot 220^2 = A^2$$

$$220\sqrt{2} = A \qquad (= 311\text{ V})$$