(1) Evaluate the following integrals using FTC part II.

(i) $\displaystyle\int_0^2 12x^5 + 3x^2 - 4x\,dx$

(ii) $\displaystyle\int_0^4 \sqrt{y}\,dy$

(iii) $\displaystyle\int_{1/2}^1 \frac{8}{x^3}\,dx$

(iv) $\displaystyle\int_4^1 t^{5/2}\,dt$

(v) $\displaystyle\int_1^{27} \frac{t+1}{\sqrt{t}}\,dt$

(vi) $\displaystyle\int_{\pi/20}^{\pi/10} \csc 5x\,\cot 5x\,dx$

(vii) $\displaystyle\int_{\pi/4}^{3\pi/4} \sin\theta\,d\theta$

(viii) $\displaystyle\int_{\pi/4}^{5\pi/8} \cos 2x\,dx$

(ix) $\displaystyle\int_{\pi/4}^{\pi/6} \sec\theta\tan\theta\,d\theta$

(x) $\displaystyle\int_{\pi/28}^{\pi/14} \csc^2 7y\,dy$

(xi) $\displaystyle\int_0^{\pi/2} \cos\left(\frac{1}{3}\theta\right)\,d\theta$

(xii) $\displaystyle\int_0^{\pi/6} \sec^2\left(3t - \frac{\pi}{6}\right)\,dt$

(xiii) $\displaystyle\int_{8/27}^1 \frac{10t^{4/3} - 8t^{1/3}}{t^2}\,dt$

(xiv) $\displaystyle\int_0^{\pi} |\cos x|\,dx$

(xv) $\displaystyle\int_0^3 |x^2 - 1|\,dx$

(xvi) $\displaystyle\int_0^5 |x^2 - 4x + 3|\,dx$

(2) A particle moves along a line so that its velocity at time t is $v(t) = t^2 - t - 6$ (measured in meters per second).
   (a) Find the displacement of the particle during the time period $1 \le t \le 4$.
   (b) Find the distance traveled by the particle during this time period.

(3) Use properties of integrals to show that $\displaystyle\int_0^{\pi/2} x\sin x\,dx \le \frac{\pi^2}{8}$. Mention any property used.

(4) Use the properties of integrals to verify the inequality without evaluating the integrals.
   (a) $\displaystyle\int_0^4 (x^2 - 4x + 4)\,dx \ge 0$
   (b) $\displaystyle\int_0^1 \sqrt{1+x^2}\,dx \le \int_0^1 \sqrt{1+x}\,dx$
   (c) $\displaystyle 2 \le \int_{-1}^1 \sqrt{1+x^2}\,dx \le 2\sqrt{2}$
   (d) $\displaystyle \frac{\pi}{12} \le \int_{\pi/6}^{\pi/3} \sin x\,dx \le \frac{\sqrt{3}\pi}{12}$