5. Evaluate the following integral.

$$\int \frac{x-9}{x^2+3x-10}dx$$

(a) $\ln|x+5| - 2\ln|x-2|$ **(b)** $2\ln|x+5| - \ln|x-2|$
(c) $\ln|x+5| + 2\ln|x-2|$ **(d)** $-\ln|x+5| - 2\ln|x-2|$
(e) $2\ln|x+5| + \ln|x-2|$

6. Which of the below integrals is equal to

$$\int \frac{\sqrt{x^2-4}}{x^6}dx$$

(with an appropriately defined θ)?

(a) $\displaystyle\int \frac{1}{16}\cos^3\theta \sin^2\theta\, d\theta$ **(b)** $\displaystyle\int \frac{1}{32}\cos^5\theta \sin\theta\, d\theta$ **(c)** $\displaystyle\int \frac{1}{16}\cos^3\theta \sin^3\theta\, d\theta$
(d) $\displaystyle\int \frac{1}{16}\frac{\cos^2\theta}{\sin^6\theta}d\theta$ **(e)** $\displaystyle\int \frac{1}{32}\frac{\cos\theta}{\sin^6\theta}d\theta$

7. Using the comparison theorem, which of the following integrals is convergent?

(i) $\displaystyle\int_1^\infty \frac{x\sin^2 x}{\sqrt[3]{1+x^7}}dx$ (ii) $\displaystyle\int_1^\infty \frac{dx}{x+e^{2x}}$ (iii) $\displaystyle\int_2^\infty \frac{x^2}{\sqrt{x^6-1}}dx$

(a) (i) only **(b)** (ii) only **(c)** (i) and (ii) only **(d)** (i) and (iii) only **(e)** (ii) and (iii) only

8. Consider the sequence defined by $a_1 = 2$, $a_{n+1} = \frac{1}{2}(a_n + 6)$. Which of the following statements is correct?

(a) $\{a_n\}$ is increasing and bounded above by 3
(b) $\{a_n\}$ converges to 5
(c) $\{a_n\}$ is increasing and bounded above by 5
(d) $\{a_n\}$ is increasing and bounded above by 6
(e) $\{a_n\}$ diverges

9. Determine whether the following sequences are convergent or divergent. When convergent, find the limit.

(i) $a_n = \dfrac{(-1)^n n^3}{n^3+2n^2+1}$
(ii) $a_n = n\sin(n\pi)$

(a) diverges, diverges **(b)** diverges, 0 **(c)** 0, 0 **(d)** 1, diverges **(e)** 1, 0