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HSC Extension 2 Mathematics Revision Questions - Set 1

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1. $\int \cos^4 x \, \mathrm{d}x$

2. By writing sec x as $\frac{\cos x}{\cos^2 x}$ evaluate $\int \sec x \, \mathrm{d}x$

3. Evaluate $\sum_{n=1}^{\infty} \frac{n}{2^n}$

4. Evaluate $\sum_{r=0}^{n} \frac{1}{\sqrt{r+1}+\sqrt{r}}$

5. Using integration by parts, show that

$$\text{If } \; I_n = \int_0^x (1+t^2)^n \mathrm{d}t$$

$$\text{then } \; I_n = \frac{1}{2n+1}\left[x(1+x^2)^n + 2nI_{n-1}\right]$$

6. Find an expression for $\cos^2\theta + \cos^2 2\theta + \cos^2 3\theta + ... + \cos^2 n\theta$

7. Show that $\cos\frac{2\pi}{5} + \mathrm{i}\sin\frac{2\pi}{5}$ is a solution of

$$x^4 + x^3 + x^2 + x + 1 = 0$$

   Hence find an exact value for $\cos\frac{2\pi}{5}$

8. Solve $\sin\theta = \cos 5\theta$ for $0 \le \theta \le 2\pi$

9. Evaluate $\int_{-1}^{0} \frac{4x^2-5x-7}{(x-1)(x^2+x+2)}\mathrm{d}x$

10. Let $z_1 = -1 + \mathrm{i}$ and $z_2 = \sqrt{3} + \mathrm{i}$. Find an exact value for $\cos\frac{7\pi}{12}$ by considering $\frac{z_1}{z_2}$.

11. Prove, without using induction, that $\sum_{i=1}^{n} n^2 = \frac{n}{6}(n+1)(2n+1)$