

**Universiti Teknologi Malaysia**  
**Department of Mathematics**

**SSCE 1693 Engineering Mathematics**

**Instruction:** Answer all questions.

Test 2(25%)

Time: 90 minutes

1. Evaluate  $\int \frac{\sqrt{\tan^{-1} x}}{2 + 2x^2} dx$

[ 5 marks]

2. Evaluate  $\int \frac{e^x}{25 - e^{2x}} dx$

[ 5 marks]

3. Given that  $y = \tan^{-1} \left( \frac{x^3}{a} \right)$  for  $a > 0$ , find  $\frac{dy}{dx}$ . Hence or otherwise, evaluate

$$\int_0^2 \frac{x^2}{16 + x^6} dx.$$

[ 6 marks]

4. Evaluate

$$\int \frac{dx}{\sqrt{2x^2 - 12x + 19}}.$$

[ 7 marks]

5. Evaluate  $\int \sinh^{-1}(2x) dx$ .

[ 7 marks]

6. Show that  $\int_1^\infty \frac{dx}{(x+3)\sqrt{x-1}} = \frac{1}{2}\pi$ . [Substitute  $x-1 = t^2$ ,  $t > 0$ .]

[ 6 marks]

7. Show that  $\int_a^b \frac{dx}{\sqrt{(x-a)(b-x)}} = \pi$  by substitution  $x = a \cos^2 \theta + b \sin^2 \theta$ .

[ 7 marks]

8. If  $y = \ln(\cos x)$ , show that

$$\frac{d^3 y}{dx^3} + 2 \left( \frac{d^2 y}{dx^2} \right) \left( \frac{dy}{dx} \right) = 0.$$

Hence deduce the expansion of  $\ln(\cos x)$  in ascending power of  $x$  up to  $x^4$ .

[ 7 marks]