

AA 97 F  
LOCKING 11.62  
MATHS (AS)

**ROYAL AIR FORCE—AIRCRAFT APPRENTICES**

**No. 1 Radio School, Locking**

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FINAL EXAMINATION IN EDUCATIONAL SUBJECTS

JANUARY 1961 (97<sup>TH</sup>) ENTRY

NOVEMBER 1962

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**MATHEMATICS**  
(Advanced Stream)

Time allowed—Three hours

*Candidates are to attempt any SIX questions*

*All questions carry equal marks*

[P.T.O.]

1. (a) (i) Given that

$$\omega = \sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}, \text{ and}$$

$$I = \frac{ER}{R^2 + \omega^2 L^2},$$

prove that

$$\frac{E}{I} = \frac{L}{CR}.$$

(ii) Evaluate  $I$  when  $E = 2$ ,  $R = 7.6$ ,  $\omega = 0.031$  and  $L = 16.2$ .

(b) Solve the equation

$$2\sqrt{t} - 7 + \frac{4}{\sqrt{t}} = 0$$

correct to three significant figures. (Hint: write  $\sqrt{t} = x$ .)

2. (a) The factors of  $A^3 - B^3$  are  $(A - B)(A^2 + AB + B^2)$ . Using this solve the equation  $x^3 = 1$  completely. If the two complex roots are denoted by  $\alpha$  and  $\beta$ , show that  $\alpha = \beta^2$ .

(b) Simplify

(i)  $(3 + 2j)(1 + j)(5 - 4j)$ , and

(ii)  $6(\cos 50^\circ + j \sin 50^\circ) \div \frac{1}{2(\cos 20^\circ + j \sin 20^\circ)}$ .

3. (a) Evaluate without using tables

(i)  $\log_{64}(\frac{1}{2})$ , and

(ii)  $\log_{\frac{1}{4}}(125)$ .

(b) Simplify

(i)  $\log_{10} 20 + 7 \log_{10} \frac{15}{16} + 5 \log_{10} \frac{24}{25} + 3 \log_{10} \frac{80}{81}$ , and

(ii)  $\log \frac{15}{16} + \log \frac{64}{81} - \log \frac{4}{27}$ .

(c) Solve the equation

$$6^x = 126.$$

4. (a) Given that  $y = x^2$ , find  $\frac{dy}{dx}$  from first principles.

(b) Differentiate with respect to  $x$

(i)  $y = (x^2 + 3x)(x^2 - x + 2)$ ,

(ii)  $y = \frac{2x}{(1-x)^2}$ ,

(iii)  $y = x^2 \cos^2(2x)$ , and

(iv)  $y = [\log_e(\sin 5x)] \cdot e^{\cos x}$ .

(c) The distance  $s$  ft of an object moving from a fixed point, is given by

$$s = 3t^3 + 4t^2 + 6$$

after a time  $t$ .

Calculate

(i) the velocity of the object after 4 secs, and

(ii) the time taken to acquire a velocity of 100 ft/sec.

5. (a) Find the first maximum and minimum values of

$$y = \sin x + \cos x.$$

(b) Show that  $y = ae^{-pt}$  is a solution of the differential equation

$$\frac{d^2y}{dt^2} - p \frac{dy}{dt} = 2p^2y.$$

6. (a) Solve the following equations for

$$0^\circ < x^\circ < 360^\circ$$

(i)  $\sin 2x = \sin x$ , and

(ii)  $2 \sin^2 2x + \cos 2x = 0$ .

(b) In a triangle the lengths of the sides are 73 ft, 82 ft, and 91 ft. Find the angle contained between the sides of length 82 ft and 91 ft.

