

**Pearson Edexcel Level 3  
GCE Mathematics 9MA0  
Practice Paper F  
Pure Mathematics**

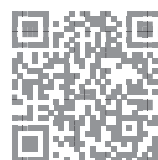
**Time allowed: 2 hours**

**Centre:**

**Name:**

**Teacher:**

Question	Points	Score
1	5	
2	4	
3	8	
4	3	
5	6	
6	6	
7	6	
8	2	
9	9	
10	5	
11	6	
12	7	
13	5	
14	4	
15	5	
16	10	
17	10	
Total:	101	







3. A curve has parametric equations

$$x = \cos(2t), \quad y = \sin(t), \quad -\pi \leq t \leq \pi.$$

(a) Find an expression for  $dy/dt$  in terms of  $t$ . [3]

Leave your answer as a single trigonometric ratio.

(b) Find an equation of the normal to the curve at the point  $A$  where  $t = -\frac{5\pi}{6}$ . [5]

Total: 8

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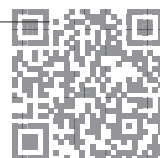
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4. Showing all steps, find

[3]

$$\int \cot(3x) dx.$$





6. The functions  $p$  and  $q$  are defined by

$$p: x \mapsto x^2 \quad \text{and} \quad q: x \mapsto 5 - 2x.$$

(a) Given that  $pq(x) = qp(x)$ , show that  $3x^2 - 10x + 10 = 0$ . [4]

(b) Explain why  $3x^2 - 10x + 10 = 0$  has no real solutions. [2]

Total: 6

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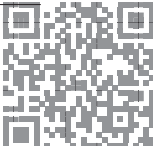
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9. At the beginning of each month Kath places £100 into a bank account to save for a family holiday. Each subsequent month she increases her payments by 5%. Assuming the bank account does not pay interest, find

(a) the amount of money in the account after 9 months. [3]

(b) Month  $n$  is the first month in which there is more than £6000 in the account. Show that [4]

$$n > \frac{\log(4)}{\log(1.05)}.$$

(c) Maggie begins saving at the same time as Kath. She initially places £50 into the same [2]  
account and plans to increase her payments by a constant amount each month.

Given that she would like to reach a total of £6000 in 29 months, by how much should Maggie increase her payments each month?

Total: 9

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11. (a) Prove that

[3]

$$\frac{\tan(x) - \sec(x)}{1 - \sin(x)} \equiv -\sec(x), \quad x \neq (2n + 1)\frac{\pi}{2}.$$

(b) Hence solve, in the interval  $0 \leq x \leq 2\pi$ , the equation

[3]

$$\frac{\tan(x) - \sec(x)}{1 - \sin(x)} = \sqrt{2}.$$

Total: 6

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12. A large arch is planned for a football stadium. The parametric equations of the arch are

$$x = 8(t + 10), \quad y = 100 - t^2, \quad -19 \leq t \leq 10$$

where  $x$  and  $y$  are distances in metres. Find

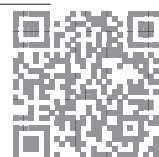
(a) the cartesian equation of the arch, [3]

(b) the width of the arch, [2]

(c) the greatest possible height of the arch. [2]

Total: 7

A series of horizontal lines provided for the student to show their working for parts (a), (b), and (c) of the question.



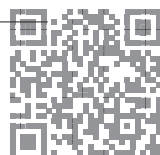




15. Find

[5]

$$\int \sin^3(x) dx.$$





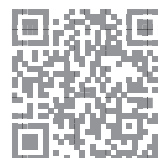
16.

$$h(t) = 40 \ln(t + 1) + 40 \sin\left(\frac{t}{5}\right) - \frac{1}{4}t^2, \quad t \geq 0.$$

The graph  $y = h(t)$  models the height of a rocket  $t$  seconds after launch.

- (a) Show that the rocket returns to the ground between 19.3 and 19.4 seconds after launch. [2]
- (b) Using  $t_0 = 19.35$  as a first approximation to  $\alpha$ , apply the Newton-Raphson procedure once to  $h(t)$  to find a second approximation to  $\alpha$ , giving your answer to 3 decimal places. [5]
- (c) By considering the change of sign of  $h(t)$  over an appropriate interval, determine if your answer to part (b) is correct to 3 decimal places. [3]

Total: 10



17. (a) Show that in  $\triangle KLM$  with  $\vec{KL} = 3i + 0j - 6k$  and  $\vec{LM} = 2i + 5j + 4k$ ,  $\angle KLM = 66.4^\circ$  to one decimal place. [7]

(b) Hence find  $\angle LKM$  and  $\angle LMK$ . [3]

Total: 10

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