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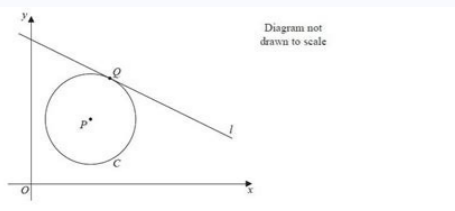
Question Number	Scheme	Marks
100	$\tan \theta = \frac{3}{4}$ $\theta = 14.036^\circ$ $\theta = 104^\circ$ nearest degree	M1 A1 A1 (3)
(b)	$p = 400i + i(15 + 20j)$ $q = 800j + i(20 - 5j)$	M1 A1 A1 (3)
101	Equating their j components: $200j = (800 - 5j)t$ $t = 32$ $s = 800j + 32(20i - 5j)$ $= 640i + 640j$	M1 A1 M1 A1 (4) 10
100	<b>Notes</b> Allow column vectors throughout M1 for $\tan \theta = \frac{3}{4}$ or $\frac{3}{4}$ (or any other complete method) First A1 for $\pm 14.04^\circ$ or $\pm 75.96^\circ$ Second A1 for $104^\circ$	
100	M1 for clear attempt at either p or q (allow slip but r must be attached to the velocity vector and position vector and velocity vector must be paired up correctly) First A1 $400i + i(15 + 20j)$ "p" not needed but must be clear it's P Second A1 $800j + i(20 - 5j)$ "q" not needed but must be clear it's Q	
101	First M1 for equating their j components; allow j's on both sides First A1 for $t = 32$ Second M1 independent for substituting their t value into their q from (b) Second A1 for $640i + 640j$	

Question Number	Scheme	Marks
2.	(a) $f'(x) = \frac{8}{3}x^{\frac{2}{3}} + \frac{2}{3}x^{-\frac{2}{3}}$   (b) $f(12.5) = 0.5115\dots$ (at least 0.51, ...) and $f'(12.5) = 16.1927\dots$ (at least 16... seen) $x_1 = 12.5 - \frac{f(12.5)}{f'(12.5)} = 12.5 - \frac{0.5115}{16.1927\dots} = 12.468$	M1 A1    B1, B1 M1 A1 (4)

6 marks

Notes

(a) M1: for attempting differentiation i.e. decrease a power by 1  
A1 Accept equivalent expression i.e. condone equivalent fractions.  
(b) B1: One correct, must be explicitly seen if final answer incorrect, may be implied by correct final answer.  
B1: Both correct; must be explicitly seen if final answer incorrect, may be implied by correct final answer.  
M1: for attempting Newton-Raphson with their values for  $f(12.5)$  and  $f'(12.5)$   
A1: cao correct to 3dp  
Newton Raphson used more than once – isw.



- (a) Find the length PQ, giving your answer in an exact value. (2)
- (b) Hence write down an equation for C. (1)
- (c) The line l is tangent to C at the point Q, as shown in Figure 2. (1)
- (d) Find an equation for l, giving your answer in the form  $ax + by + c = 0$ , where  $a, b$  and  $c$  are integers. (2)

$$z = 5\sqrt{3} - 5i$$

Find

(a)  $|z|$ . (1)

(b)  $\arg(z)$ , in terms of  $\pi$ . (2)

$$w = 2\left(\cos \frac{\pi}{4} + i \sin \frac{\pi}{4}\right)$$

Find

(c)  $\left|\frac{w}{z}\right|$ . (1)

(d)  $\arg\left(\frac{w}{z}\right)$ , in terms of  $\pi$ . (2)

Question Number	Scheme	Marks
3.	$F = \frac{1}{8} \times 0.4g$  $-\frac{1}{8} \leftarrow -0.4g = 0.4a$  $0 = u^2 + 2\left(-\frac{1}{8}g\right)(-s)$  $I = 0.4 \times (3.5 - -4) = 3Ns$	M1  M1 A1 M1 A1  M1 A1

7

Notes

3. First M1 for  $1/8 \times 0.4g$  (Allow if  $g$  omitted)  
Second M1 for resolving horizontally with their  $F$  (could just be  $F$ )  
First A1 for a correct equation in  $a$  only  
Third M1 for use of  $v^2 = u^2 + 2as$  with  $v = 0$ ,  $s = 5$  and a calculated value of  $a$ . (M0 if  $u = 4$  or if  $u = 0$ )  
Second A1 for a correct equation in  $u$  only ( $u$  may be in terms of  $I$ )  
Fourth M1 (M0 if  $g$  included or if  $u = 0$  or  $u = 4$ ) for  $\pm 0.4(u - \pm 4)$  where  $u$  is their calculated value.  
Third A1 for 3, 3.0 or 3.00 (Ns)

Alternative work – energy method:

$$\begin{aligned} F &= \left(\frac{1}{8} \times 0.4g\right) && \text{M1} \\ \therefore \frac{1}{2} 0.4u^2 &= \left(\frac{1}{8} \times 0.4g\right) \times 5 && \text{M2 A2 (M2 if } F \text{ not substituted)} \\ I &= 0.4 \times (3.5 - -4) && \text{M1} \\ &= 3 \text{ (Ns)} && \text{A1} \end{aligned}$$

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