1993 — HIGHER MATHEMATICS ANSWERS

PAPER I

1. *(a)* $\begin{pmatrix} 2 \\ 1 \\ -2 \end{pmatrix}$ *(b)* 3 units

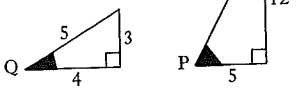
2. *(a)* $3y = 2x + 13$ *(b)* Proof {(−5, 1) satisfies equation (a)}

3. $k \leq 2$

4. $x = -1$ or 2

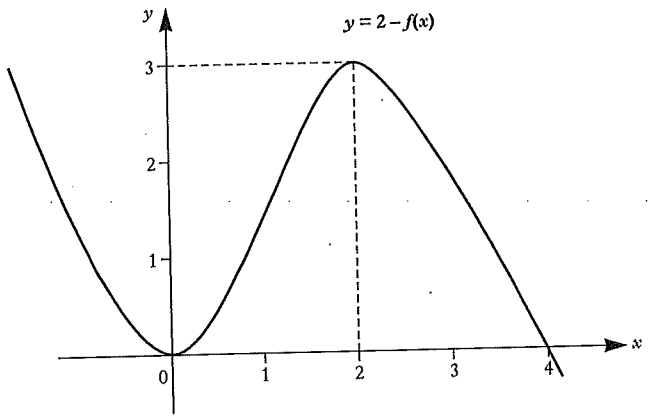
5. *(a)* (10, 6) *(b)* $(x-10)^2 + (y-6)^2 = 4$

6. Proof



7. $p = -17$ and $x = 2$ or $\frac{5}{2}$ are the other roots

8.



9. $\frac{2}{\sqrt{x}} - 6\sin 2x$

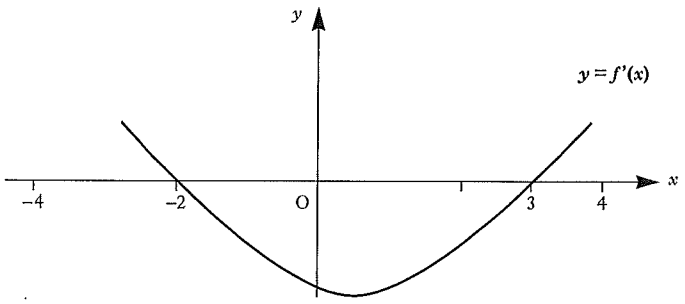
10. *(a)* $a = 63{\cdot}4$; $b = 135$ *(b)* $71{\cdot}6°$

11. $f(x) = x^2 - 3x + 4$

12. *(a)* 0 *(b)* $\underline{b} + \underline{c}$ is **perpendicular** to $\underline{a}$

13. *(a)* $k(x) = 5 - 4x$ *(b)* $h(k(x)) = x$ *(c)* $h(x) = k^{-1}(x)$ {**inverses**}

14.



15. *(a)* $a=5;\ k=0{\cdot}462$ *(b)* $y=5e^{0{\cdot}462(x-3)}$

16. $\frac{2}{9}(1+3x)^{3/2}+C;\ \frac{14}{9}$

17. $f(a)=-6\cos^2 a-\cos a+6;\ a=1{\cdot}231$ or $2{\cdot}094\ \left\{\frac{2\pi}{3}\right\}$

18. Proof $\{g^2+f^2-c<0$ (i.e. r is not **real**)$\}$

19. *(a)* Proof *(b)* $x-\frac{1}{2}\cos 2x+C$

20. $q=p^2;\ q=25$

21. Proof $\{f'(x)<0;\ x\neq -1\}$

PAPER II

1. Minimum T.P. at $\left(-\frac{1}{2},\ -\frac{27}{16}\right)$. Point of Inflexion at (1, 0)

2. *(a)* A(−12, 0); B(12, 0) *(b)* £816

3. *(a)* $x+2y=2$ *(b)* $(x-4)^2+(y+1)^2=45$

4. *(a)* 1 and 7 *(b)* $t=1$

5. *(a)* A(1, 0, 0); B(3, 2, 0); C(3, 0, −2) *(b)* $2\sqrt{3}$ units^2 *(c)* 4·7% **decrease**

6. *(a)* $A\left(\frac{7\pi}{12},0\right)$; $B\left(\frac{11\pi}{12},0\right)$ *(b)* 3 *(c)* $C\left(\frac{\pi}{2},1\right)$ lies on the line l

7. *(a)* B(−2, 5) *(b)* $m_{\text{road}}=m_{\text{circuit}}$ at B or double route implies tangency

8. *(a)* 13·05 *(b)* 3 doses *(c)* Proof $\{u_{n+1}=0{\cdot}85^4 u_n+25\}$
(d) No as limit $52{\cdot}3 < 55$

9. *(a)* Proof {various methods e.g. Cosine Rule}
(b) $8\sqrt{5}\sin(x-63{\cdot}4)^\circ$ *(c)* $\theta=114{\cdot}9$

10. *(a)* $\log_e I=-\frac{4}{5}\log_e t+4$ *(b)* Proof; $k=54{\cdot}6, r=-\frac{4}{5}$

11. *(a)* Proof {use Pythagoras}
(b) Proof {use differentiation}; £127 million, 109 km