**OCR**

# A Level

# A Level Maths

OCR Core Maths C1 June 2010
Model Solutions

Name:

**M M E**
Mathsmadeeasy.co.uk

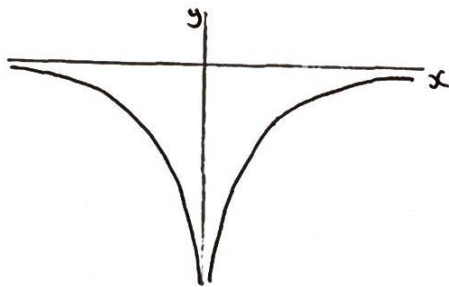Total Marks:

OCR - Jun 10    C 1

1i.    $9^0 = 1$
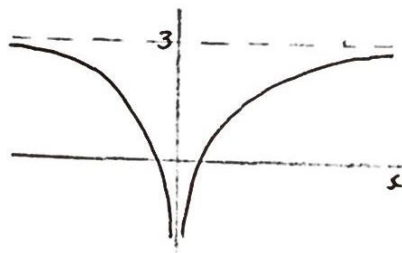
1ii.   $9^{-\frac{1}{2}} = \frac{1}{\sqrt{9}} = \frac{1}{3}$

2i.

$y = -\frac{1}{x^2}$

2ii.

$y = 3 - \frac{1}{x^2}$    (translation 3 up)

2iii.   $y = -\frac{2}{x^2}$    ( $f(x) \rightarrow 2f(x)$  stretch s.f. 2 in y direction)

3i.    $\frac{12}{3+\sqrt{5}}$ ;   $\frac{12(3-\sqrt{5})}{(3+\sqrt{5})(3-\sqrt{5})}$   $= \frac{36-12\sqrt{5}}{9-5}$ $= 9 - 3\sqrt{5}$
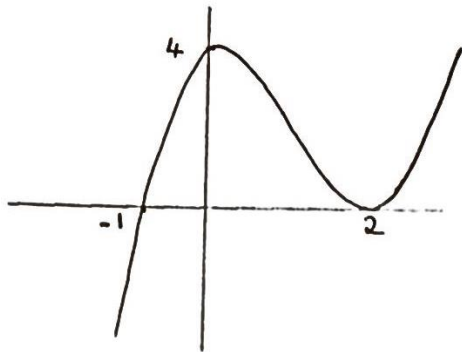
3ii.   $\sqrt{18} - \sqrt{2}$

$= \sqrt{9 \times 2} - \sqrt{2}$

$= 3\sqrt{2} - \sqrt{2}$

$= 2\sqrt{2}$

4i. $(x-2)^2(x+1)$

$= (x^2 - 4x + 4)(x+1)$

$= x^3 + x^2 - 4x^2 - 4x + 4x + 4$

$= x^3 - 3x^2 + 4$

4ii.



$y = (x-2)^2(x+1)$

when $x = 0$    $y = 4$

roots at    $x = -1$

double root at  $x = 2$

5   $4x^4 + 3x^2 - 1 = 0$          let $y = x^2$

$4y^2 + 3y - 1 = 0$                    $y^2 = x^4$

$(4y - 1)(y + 1) = 0$

$y = -1$                    or          $4y = 1$

$x = \sqrt{-1}$  ✗                        $y = \frac{1}{4}$

                                              $x = \sqrt{\frac{1}{4}}$

                                              $= \pm \frac{1}{2}$

6.   $y = 2x + \dfrac{6}{\sqrt{x}}$

$y = 2x + 6x^{-1/2}$

$\dfrac{dy}{dx} = 2 - 3x^{-3/2}$

$x = 4 \; ; \; \dfrac{dy}{dx} = 2 - \dfrac{3}{\sqrt{4^3}}$

$= \dfrac{13}{8}$

7.   $x + 2y - 6 = 0$   $\Rightarrow$   $x = 6 - 2y$   ①

$2x^2 + y^2 = 57$   ②

'sub ① into ②'

$2(6 - 2y)^2 + y^2 = 57$

$2(36 - 24y + 4y^2) + y^2 = 57$

$9y^2 - 48y + 15 = 0$

$3y^2 - 16y + 5 = 0$

$(3y - 1)(y - 5) = 0$

$y = 5$   or   $y = 1/3$

$y = 5$ ;   $x = 6 - 2(5) = -4$

$y = 1/3$ ;   $x = 6 - 2(\frac{1}{3}) = 16/3$
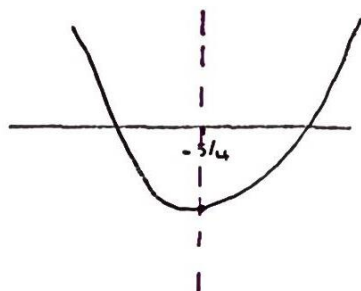
8i.   $2x^2 + 5x$

$= 2[x^2 + 5/2 x]$

$= 2[(x + 5/4)^2 - (5/4)^2]$

$= 2(x + 5/4)^2 - 2(\frac{25}{16})$

$= 2(x + 5/4)^2 - 25/8$

8ii.   Min. at $(-5/4, -25/8)$
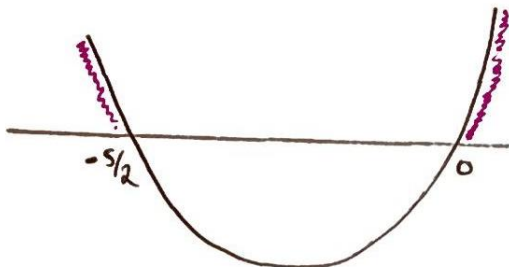
8.iii.   Normal :   $x = -5/4$

8iv.

$2x^2 + 5x > 0$

$x(2x+5) > 0$

C.V.s :    $x = 0$    $x = -5/2$



$\therefore$    $x < -5/2$ ,

$x > 0$

9i.

$A(4, 5)$     $B(p, q)$     $M(-1, 3)$

$\dfrac{4+p}{2} = -1$         $\dfrac{5+q}{2} = 3$

$4 + p = -2$           $5 + q = 6$

$p = -6$               $q = 1$

9ii.

$|AB| = \sqrt{(4--6)^2 + (5-1)^2} = \sqrt{116} = \sqrt{4 \times 29} = 2\sqrt{29}$
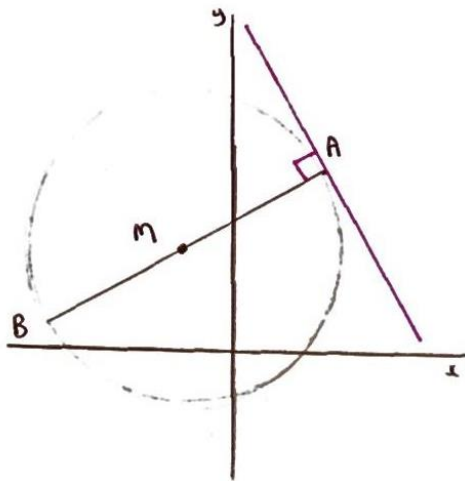
$\therefore$ radius $= \sqrt{29}$

9iii.

centre at $(-1, 3)$   radius $\sqrt{29}$

$\Rightarrow$     $(x+1)^2 + (y-3)^2 = 29$

$x^2 + 2x + 1 + y^2 - 6y + 9 - 29 = 0$

$x^2 + y^2 + 2x - 6y - 19 = 0$

9.iii.



A tangent to a circle is perpendicular to the radius.

grad of MA $= \frac{5-3}{4--1} = \frac{2}{5}$

∴ grad of tangent $= -\frac{5}{2}$ (Since ⊥)

$y - 5 = -\frac{5}{2}(x - 4)$

$2y - 10 = -5x + 20$

$2y + 5x = 30$

10:.

$y = 2x^3 + 5x^2 - 4x$

$\frac{dy}{dx} = 6x^2 + 10x - 4$ 
at stat. points $\frac{dy}{dx} = 0$

$6x^2 + 10x - 4 = 0$

$3x^2 + 5x - 2 = 0$

$(3x - 1)(x + 2) = 0$

$x = \frac{1}{3}$ or $-2$

$x = \frac{1}{3}$ ; $y = 2\left(\frac{1}{27}\right) + 5\left(\frac{1}{9}\right) - 4\left(\frac{1}{3}\right)$

$= \frac{2}{27} + \frac{15}{27} - \frac{36}{27}$

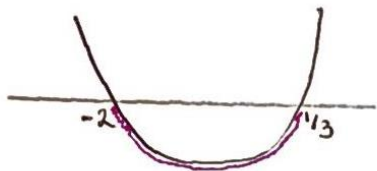$= -\frac{19}{27}$

$x = -2$ ; $y = 2(-8) + 5(4) - 4(-2)$

$= -16 + 20 + 8$

$= 12$ , st. pt. $\left(\frac{1}{3}, -\frac{19}{27}\right), \left(-2, 12\right)$

10ii. A function is decreasing when $\frac{dy}{dx} < 0$

$\therefore \quad (3x-1)(x+2) < 0$

c.v.s $\quad x = \frac{1}{3} \quad x = -2$



$\therefore \quad -2 < x < \frac{1}{3}$

10iii. When $x = \frac{1}{2}$, $\quad y = 2\left(\frac{1}{2}\right)^3 + 5\left(\frac{1}{2}\right)^2 - 4\left(\frac{1}{2}\right)$

$= \frac{1}{4} + \frac{5}{4} - 2$

$= -\frac{1}{2}$

Point at $\left(\frac{1}{2}, -\frac{1}{2}\right)$

when $x = \frac{1}{2}$, $\quad \frac{dy}{dx} = 6\left(\frac{1}{2}\right)^2 + 10\left(\frac{1}{2}\right) - 4$

$= \frac{3}{2} + 1$

$= \frac{5}{2}$

$y + \frac{1}{2} = \frac{5}{2}\left(x - \frac{1}{2}\right)$

$y + \frac{1}{2} = \frac{5x}{2} - \frac{5}{4} \quad (\times 4)$

$4y + 2 = 10x - 5$

$10x - 4y - 7 = 0$

10iv.

$y = 2x^3 + 5x^2 - 4x$

$y = \frac{5}{2}x - \frac{7}{4}$ (same as (iii) so tangent when $x = \frac{1}{2}$)



2 points of intersection
$\Rightarrow$ 2 d.r.r.