Edexcel

A Level

A Level Maths

Edexcel Core Maths C1 January 2011 Model Solutions

Name:

MME
Mathsmadeeasy.co.uk

Total Marks:

Edexcel Jan 11 C1

1a. $16^{-\frac{1}{4}} = \frac{1}{\sqrt[4]{16}} = \frac{1}{2}$

1b. $x(2x^{-\frac{1}{4}})^4 = x(2^4 x^{-1}) = 2^4$

$= 16$

2. $\int 12x^5 - 3x^2 + 4x^{1/3} \, dx$

$= \frac{12}{6}x^6 - \frac{3}{3}x^3 + \frac{4}{4/3}x^{4/3} + c$

$= 2x^6 - x^3 + 3x^{4/3} + c$

3. $\frac{5 - 2\sqrt{3}}{\sqrt{3} - 1}$ Multiply by $\sqrt{3} + 1$

$\frac{(5 - 2\sqrt{3})(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)} = \frac{5\sqrt{3} + 5 - 6 - 2\sqrt{3}}{3 + \sqrt{3} - \sqrt{3} - 1} = \frac{3\sqrt{3} - 1}{2}$.

$\therefore \quad -\frac{1}{2} + \frac{3}{2}\sqrt{3}$

4a. $a_{n+1} = 3a_n - c \qquad a_1 = 2$

$a_2 = 3a_1 - c$

$= 3(2) - c$

$= 6 - c$

4b. $\sum_{i=1}^{3} a_i = 0 \quad \Rightarrow \quad a_1 + a_2 + a_3 = 0$

$a_3 = 3a_2 - c$

$= 3(6-c) - c$

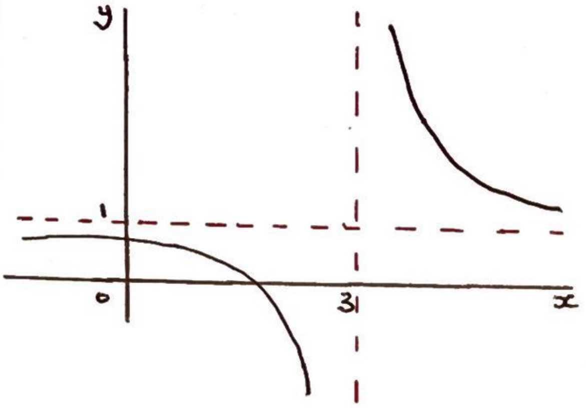
$= 18 - 4c$

$\therefore \quad 2 + 6 - c + 18 - 4c = 0$

$26 = 5c$

$c = \frac{26}{5}$

5a.



5b.

$f(x) = \frac{x}{x-2}$

$f(x-1) = \frac{x-1}{x-1-2} = \frac{x-1}{x-3}$

$y = \frac{x-1}{x-3}$

when $x=0$; $y = \frac{0-1}{0-3} = 1/3$ $\therefore$ $(0, 1/3)$

when $y=0$; $0 = \frac{x-1}{x-3}$

$x-1 = 0$ $\therefore$ $x = 1$ $\therefore$ $(1,0)$

6a.

$S_{10} = \frac{1}{2}(10)\left(2a + (10-1)d\right) = 162$

$5(2a + 9d) = 162$

$10a + 45d = 162$ ①

6b.

$u_6 = a + (6-1)d = 17$

$a + 5d = 17$

6c.

$a + 5d = 17 \Rightarrow a = 17 - 5d$ 'sub in ①'

$10(17-5d) + 45d = 162$

$170 - 50d + 45d = 162$

$5d = 8$ $d = 1.6$

6c. $d = 1.6 \quad \therefore \quad a = 17 - 5(1.6)$

$= 17 - 8$

$= 9$

7. $f'(x) = 12x^2 - 8x + 1$

$f(x) = \int f'(x)\,dx$

$= \int 12x^2 - 8x + 1 \,dx$

$= \frac{12}{3}x^3 - \frac{8}{2}x^2 + x + c$

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

passes through $(-1, 0)$

$\therefore \quad 0 = 4(-1)^3 - 4(-1)^2 + (-1) + c$

$0 = -4 - 4 - 1 + c$

$c = 9$

$\therefore \quad f(x) = 4x^3 - 4x^2 + x + 9$

8a. $x^2 + (k-3)x + (3-2k) = 0$

2 d.r.r. $\Rightarrow \quad b^2 - 4ac > 0$

$(k-3)^2 - 4(1)(3-2k) > 0$

$k^2 - 6k + 9 - 12 + 8k > 0$

$k^2 + 2k - 3 > 0$

8b. $(k+3)(k-1) > 0$

c.v.'s $\quad k = 1, \quad k = -3$

$\therefore \quad k < -3$

$k > 1$

9a. $2y - 3x - k = 0$ A $(1,4)$

$2(4) - 3(1) - k = 0$

$8 - 3 = k$

$k = 5$

9b. $2y - 3x - 5 = 0$

$2y = 3x + 5$

$y = \frac{3}{2}x + \frac{5}{2} \Rightarrow$ grad. $= \frac{3}{2}$

9c. $\perp$ $\therefore$ grad of $L_2 = -\frac{2}{3}$

$y - 4 = -\frac{2}{3}(x - 1)$

$y - 4 = -\frac{2}{3}x + \frac{2}{3}$ $\times 3$

$3y - 12 = -\frac{2}{\cancel{3}}x + 2$

$2x + 3y - 14 = 0$

9d. $y = 0 \Rightarrow 2x - 14 = 0$

$x = 7$

$B\ (7,0)$

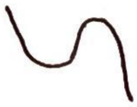
9e. $|AB| = \sqrt{(7-1)^2 + (0-4)^2}$

$= \sqrt{36 + 16}$

$= \sqrt{52}$

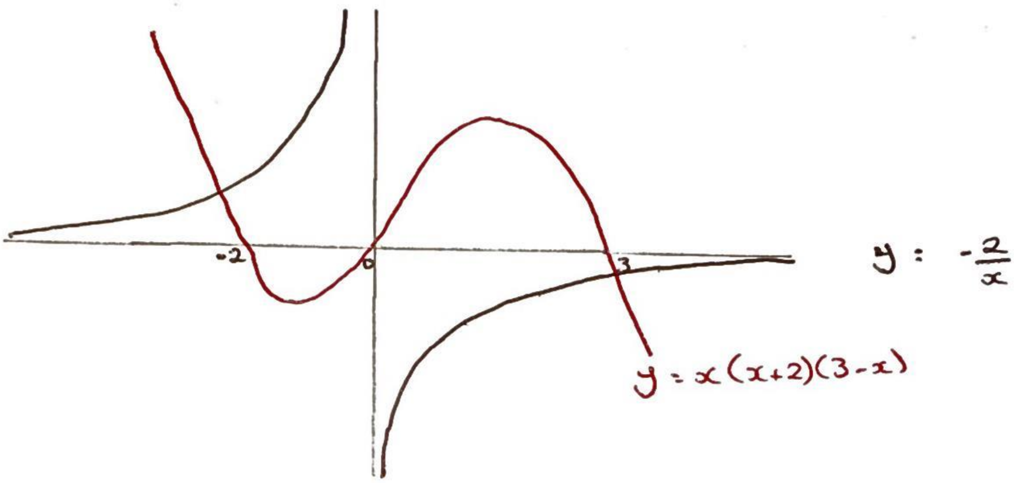
$= 2\sqrt{13}$

10a. $y = x(x+2)(3-x)$

negative cubic $\therefore$  shape

crosses x axis at 0, -2 and 3

crosses y axis at 0 (when $x = 0$)



10b. 2 intersections $\therefore$ 2 real solutions

11a. $y = \frac{1}{2}x^3 - 9x^{3/2} + \frac{8}{x} + 30$

$$\frac{dy}{dx} = \frac{3}{2}x^2 - \frac{27}{2}x^{1/2} - 8x^{-2}$$

11b. at P $x = 4$ $y = -8$

so
$$-8 = \frac{1}{2}(4)^3 - 9(4)^{3/2} + \frac{8}{4} + 30$$
$$= \frac{1}{2}(64) - 9(8) + 2 + 30$$
$$= 32 - 72 + 32$$
$$= -8$$

$\therefore$ P lies on C

11c. at $(4, -8)$ grad $= \frac{3}{2}(4)^2 - \frac{27}{2}(4)^{1/2} - \frac{8}{4^2}$
$$= \frac{3}{2}(16) - \frac{27}{2}(2) - \frac{8}{16}$$
$$= 24 - 27 - 1/2$$
$$= -7/2$$

$\therefore$ m of normal $= \frac{2}{7}$

$y - -8 = \frac{2}{7}(x-4)$

$y + 8 = \frac{2}{7}(x-4)$

$7y + 56 = 2x - 8$

$7y - 2x + 64 = 0$