| Half Term 4C (ANSWERS) | Week 1 |
|---|---|

**1**

$120 = 200e^{-10k}$

$e^{-10k} = 0.6$

$-10\,k = \ln 0.6$

$k = \frac{\ln 0.6}{-10}$

$k = 0.0511$

**2**

$\log_a(x+3) - \log_a 2 = \log_a 3x$

$\log_a \frac{(x+3)}{2} = \log_a 3x$

$\frac{(x+3)}{2} = 3x \quad 6x = x + 3 \qquad 5x = 3 \qquad x = \frac{3}{5}$

**3**

$p + 3q = 5 \quad 3p + 9q = 15$

$3p + 4q = 5$

$5q = 10$

$q = 2 \qquad p = -1$

**4**

$\int 3x^2 - 2x + 4\,dx = x^3 - x^2 + 4x + c$

**5**

$(x-1)^2 - 1 + (y-1)^2 - 1 - 23 = 0$

$(x-1)^2 + (y-1)^2 = 25$

Centre (1, 1) Gradient of line from centre to (5,4) $= \frac{3}{4}$

Gradient of tangent $= \frac{4}{3}$ $(y-4) = \frac{4}{3}(x-5)$

$3y + 4x = 32$

| Half Term 4C (ANSWERS) | Week 2 |
|---|---|

**1**

$(3x + 1)\ log\ 3 = log\ 18$

$3x\ log\ 3 + log 3 = log\ 18$

$3x\ log\ 3 = log\ 6$

$x = \frac{log\ 6}{3\ log\ 3}$

**2**

$\frac{1}{5} log 32 - 2\ log\ 4 + log 64$

$= log 32^{\frac{1}{5}} - 2\ log\ 2^2 + log 2^6$

$= log 2 - 4\ log\ 2 + 6 log 2$

$= log\ 8$

**3**

$\overrightarrow{AB} = \begin{bmatrix} -4 \\ 10 \end{bmatrix}$ $\quad |\overrightarrow{AB}| = \sqrt{4^2 + 10^2}$

$= \sqrt{116}$

$|\overrightarrow{BM}| = \frac{\sqrt{116}}{2}$

$= \sqrt{29}$

**4**

$\int 10x - 3x^2 + 8\ dx = 5x^2 - x^3 + 8x + c$

**5**

$(x - 3)^2 - 9 + (y - 2)^2 - 4 - 23 = 0$

$(x - 3)^2 + (y - 2)^2 = 6^2$

Centre (3, 2) Radius 6

| Half Term 4C (ANSWERS) | Week 3 |
|---|---|

**1**

$(3x-2)log2 = log6$

$3xlog2 = log24$

$x = \frac{log24}{log8}$

**2**

$\boldsymbol{log_4 64 + log_3 27}$

$\boldsymbol{log_4 4^3 + log_3 3^3}$

$\boldsymbol{= 3 + 3}$

$\boldsymbol{= 6}$

**3**

$\overrightarrow{AB} = (6-3)i + (10--2)j$

$= 3i + 12j$

$|\overrightarrow{AB}| = \sqrt{3^2 + 12^2}$

$= \sqrt{153}$

$= 3\sqrt{17}$

**4**

$\int 2x^3 - 5x^2 - 3x\, dx = \frac{1}{2}x^4 - \frac{5}{3}x^3 - \frac{3}{2}x^2 + c$

**5**

*$(x + 1)^2 + (y - 3)^2 = 5^2$*
*Intersects the x-axis when $y = 0$*
*$(x + 1)^2 + (- 3)^2 = 5^2$*
*$x^2 + 2x + 1 + 9 = 25$*
*$x^2 + 2x - 15 = 0$*
*$(x + 5)(x - 3) = 0$* *Intersects the x- axis at $x = -5$ and $x = 3$*

| Half Term 4C (ANSWERS) | Week 4 |
|---|---|

**1**

$30e^{-0.4t} = 15$

$e^{-0.4t} = 0.5$

$-0.4t = \ln 0.5$

$t = \frac{\ln 0.5}{-0.4}$

$t = 1.73$ seconds

**2**

$3\log x + 4\log y - 2\log(xy)$

$= \log x^3 + \log y^4 - \log x^2y^2$

$= \log \frac{x^3y^4}{x^2y^2}$

$= \log(xy^2)$

**3**

$\tan 30° = \frac{a}{4\sqrt{3}}$

$a = 4$

**4**

$\int 6x^2 + 4x - 3\, dx = 2x^3 + 2x^2 - 3x + c$

$(16 + 8 - 6) - (2 + 2 - 3) = 17$

**5**

$x^2 + y^2 = 5^2$

$x = 1 - y$

$(1 - y)^2 + y^2 = 25$

$1 - 2y + 2y^2 - 25 = 0$

$2y^2 - 2y - 24 = 0$

$y^2 - y - 12 = 0$

$(y - 4)(y + 3) = 0$

$y = 4 \quad x = -3 \quad (-3, 4)$

$y = -3 \quad x = 4 \quad (4, -3)$

| Half Term 4C (ANSWERS) | Week 5 |
|---|---|

**1**

$15000e^{-0.3t} = 5000$

$e^{-0.3t} = \frac{1}{3}$

$t = \frac{ln\frac{1}{3}}{-0.3}$

$t = 3.66 \text{ years}$

**2**

$log_3(4x + 1) = 2$

$4x + 1 = = 3$

$4x + 1 = 9$

$x = 2$

**3**

$Magnitude\ of \begin{bmatrix} 3 \\ -4 \end{bmatrix}\ is\ \sqrt{3^2 + (-4)^2} = 5$

$5 \times 4 = 20 \qquad 4 \times \begin{bmatrix} 3 \\ 4 \end{bmatrix} = \begin{bmatrix} 12 \\ -16 \end{bmatrix}$

**4**

$\int 4x - 3x^2 + 1\ dx = 2x^2 - x^3 + x + c$

$(8 - 8 + 2) - (0) = 2$

**5**

$Radius = 5 \qquad Centre\ (3,5)$

$(x - 3)^2 + (y - 5)^2 = 25$

| Half Term 4C (ANSWERS) | Week 6 |
|---|---|

**1**

$4000 \times 1.035^t = 10000$

$1.035^t = 2.5$

$t \ln 1.035 = \ln 2.5$

$t = 26.6$ years

**2**

$2\log_a 4 - \log_a 4 + \frac{1}{2}\log_a 16 = \frac{1}{2}\log_a x$

$\log_a 4 + \log_a 4 = \frac{1}{2}\log_a x$

$\log_a 4^2 = \log_a x^{\frac{1}{2}}$

$x^{\frac{1}{2}} = 16 \quad x = 256$

**3**

$\overrightarrow{AB} = \begin{bmatrix}3\\4\end{bmatrix} - \begin{bmatrix}-1\\2\end{bmatrix}$

$= \begin{bmatrix}4\\2\end{bmatrix} \qquad \theta = \tan^{-1}\left(\frac{2}{4}\right)$

$\theta = 26.6°$

**4**

$\int 2x^2 + 12x + 18\, dx = \frac{2}{3}x^3 + 6x^2 + 18x + c$

$\left(\frac{2}{3} + 6 + 18\right) - \left(-\frac{2}{3} + 6 - 18\right) = 37\frac{1}{3}$

**5**

Centre of circle $= \left(\frac{7-1}{2}, \frac{-1+5}{2}\right) = (3,\ 2)$

Radius of circle $= \frac{1}{2}\sqrt{8^2 + 6^2} = 5$

$(x - 3)^2 + (y - 2)^2 = 25$

$x = 0$

$9 + y^2 - 4y + 4 - 25 = 0$

$y^2 - 4y - 12 = 0$

$(y - 6)(y + 2) = 0$ (0,6) (0,-2)

| Half Term 4C (ANSWERS) | Week 7 |
|---|---|

**1**

$m_0 e^{-60k} = \frac{m_0}{2}$

$e^{-60k} = 0.5$

$-60k = ln\, 0.5$

$k = \frac{ln\, 0.5}{-60}$ $\quad k = 0.0116$

**2**

$log_2(x^2 + 4) = log_2 8$

$x^2 + 4 = 8$

$x^2 = 3$

$x = \pm\sqrt{2}$ $\quad x = \sqrt{2}$

**3**

$M = \left(\frac{2+6}{2}, \frac{5-3}{2}\right)$

$= (4, 1)$

$\overrightarrow{CM} = \begin{bmatrix}4\\1\end{bmatrix} - \begin{bmatrix}-1\\4\end{bmatrix}$

$= \begin{bmatrix}5\\-3\end{bmatrix}$

**4**

$\int 3x^2 + 10x - 2\, dx = x^3 + 5x^2 - 2x + c$

$(8 + 20 - 4) - (1+5 -2) = 20$

**5**

$(x - 2)^2 - 4 + (y + 1)^2 - 1 - 8 = 0$

$(x - 2)^2 + (y + 1)^2 = 13$

Centre (2, -1) Gradient of line from centre to (0,2) $= \frac{3}{2}$

Gradient of tangent $= \frac{2}{3}$ $\quad (y - 2) = \frac{2}{3}x$

$3y - 2x = 6$