For the final ten days leading up to the first AS Maths exam paper (8MA0/01 for Edexcel), we will publish four exam questions. Three of the questions will focus on the Pure Mathematics content, and one of the questions will focus on Mechanics content. There will be no questions on Statistics content. The three questions will vary in difficulty, but they will usually increase in difficulty. You may use a calculator for any of the questions and solutions are provided on a separate document.

1 (a) Express $4(2 - 3x) - 6x^2 + 1$ in the form $a(x + b)^2 + c$, where a, b and c are integers to be found.

(b) Find the coordinates of the turning point on the curve with equation $y = 4(2 - 3x) - 6x^2 + 1$.

(c) Is the turning point found in part (b) a maximum point or a minimum point?

2 The amount of a drug in a person's system, D milligrams, after t hours from the first dose is modelled by $D = Ab^t$, where A and b are constants.

(a) Show that a graph of $\ln(D)$ against t is a straight line.

The line l is a graph of $\ln(D)$ against t.

Given that the line passes through the points $(2, 2.20)$ and $(5, 0.40)$,

(b) find the values of the constants A and b.

(c) Use the model to estimate the amount of drug in the person's system after 3 hours.

(d) Find the time taken for the amount of drug in the person's system to fall to 5% of the original dose.

After 6 hours, the patient is given a second dose of 20 milligrams of the drug. The model for the amount of drug in their system, D milligrams, after t hours from the second dose is modelled by $D = 10(2)^{-0.3t} + C$, where C is a constant.

(e) Find the value of C.

3 The curve C has the equation $y = f(x)$, where

$$f'(x) = \frac{1 - \sqrt{x}}{x^2}, \ x > 0$$

(a) Given that C passes through the point $A(1, 8)$, express y in terms of x.

The curve C also passes through the point $B(4, k)$, where k is a constant.

(b) Find the distance between the points A and B.

4 A particle P moves in a straight line with a constant acceleration of a m s^{-2}. Given that at time $t = 0$ s, the velocity of the particle is u m s^{-1} and the displacement of the particle is 0 m,

(a) prove that the velocity, v m s^{-1}, of P at time t can be given by $v = u + at$,

(b) prove that the displacement, s m, of P at time t can be given by $s = ut + 0.5at^2$.

(c) Using the results in parts (a) and (b), deduce that $v^2 - u^2 = 2as$.

END OF WORKSHEET