1. Show how equation A can be rearranged to give Equation B. Show all your working.

[6]

Equation A: $a = \dfrac{b(\ln y - 2\ln A)}{x^2 - 1}$

Equation B: $y = A^2 e^{\left(\frac{ax^2 - a}{b}\right)}$

2. (i) Solve the simultaneous equations:

[5]

$$x + \frac{y}{3} = 2.5$$
$$3x + 2y = 13.5$$

3. Combine the two functions *f(x)* and *g(x)* to give expressions for *f(g(x))* and *g(f(x))*.

[5]

$$f(x) = x\sin^4\left(x^3\right)$$
$$g(x) = \sqrt{x}$$

4. (i) Determine the *x*-coordinates of the turning points of the following cubic equation by differentiating and factorising. Show all your working.

[7]

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

(ii) Sketch the function below marking the points at which it crosses both axes **and** the coordinates of the maxima/minima. [6]

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

5. For the function $f(x) = \left(\frac{1}{e^{(x-2)} + 3} \right)$ evaluate the following limits:

[3×4]

(i) $\lim_{x \to 0} \left(\frac{1}{e^{(x-2)} + 3} \right)$

(ii) $\lim_{x \to -\infty} \left(\frac{1}{e^{(x-2)} + 3} \right)$

(iii) $\lim_{x \to 2} \left(\frac{1}{e^{(x-2)} + 3} \right)$

6. (i) Change the base of the following logarithmic expression from 3 to base 10 and simplify as far as possible:

[5]

$\log_3 \left(10x^4\right)$

(ii) Expand and simplify the following logarithmic expression:

[5]

$\log_3 \left(\frac{27}{x^2} \right)$

7. What is the derivative of y for each of the following functions?

[4×4]

(i) $y = \tan(x) + 2e^{5x} - \frac{1}{x^2}$

(ii) $y = x^2 \tan(3x)$

(iii) $y = \ln(x^3 - 1)\sqrt{x^2 - 2}$

(iv) $y = (e^{2x} + 2x)^2$