Pure 38 – Differentiation: Trig, Exponentials, Logs & Chain Rule

Please **complete** this homework by ___________. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics.
Please complete all questions.

1. Differentiate these functions:

a) $y = 3x^2$ b) $y = x^3 + 5$ c) $y = x^5 + 4x^3 + 2x$
d) $f(x) = 5$ e) $f(x) = 2x$ e) $f(x) = x(x^3 + 4)$

2. Differentiate these functions:

a) $f(x) = \sqrt{x}$ b) $f(x) = 6x^{-2}$ c) $f(x) = x + \frac{1}{x}$
d) $y = x^{\frac{2}{3}} + x^{\frac{5}{3}}$ e) $y = x^2 - \frac{8}{x^2}$ f) $y = \frac{2x^3+3x}{\sqrt{x}}$

3. Prove from first principles that the derivative of x^2 is 2x.

4. Find the equation of the tangent to the curve $y = 2x^3 + 6x + 10$ at the point (-1,2).

5. Find the coordinates of the point where the tangent to the curve $y = x^2 + 1$ at the point (2,5) meets the normal to the same curve at the point (1,2).

6. Simplify $\sqrt{75} - \sqrt{12}$ giving your answer in the form $a\sqrt{b}$ where a and b are integers to be found.

7. Write $2 + 0.8x - 0.04x^2$ in the form $A - B(x + C)^2$.

8. Given that the function $f(x) = sx^2 + 8x + s$ has equal roots, find the value of the positive constant s.

9. Given that the simultaneous equations $y - x = k$ and $x^2 + y^2 = 4$ have exactly one pair of solutions, show that $k = \pm 2\sqrt{2}$.

10. Find the set of values of x for which $x^2 - 5x - 14 > 0$. Write your answer using set notation.

Section 2 – Consolidation of this week's topic.
Please complete all questions.

1) Differentiate with respect to x and simplify where possible:

a) $y = 2\cos x$ b) $\mathrm{f(x)} = \sin 4x$ c) $y = 5\sin(\frac{\pi x}{3})$

d) $\mathrm{f(x) = 3sin2x + 5cosx}$ e) $\mathrm{y = \frac{3x^4+2xsinx}{x}}$ **[7]**

2) Prove from first principles that the derivative of $\cos 3x$ is $-3\sin 3x$. **[5]**

3) A curve has the equation $y = x + \cos x$. Find the equation of the tangent to the curve at $x = \frac{\pi}{6}$, leaving your answer exact. **[4]**

4) Differentiate with respect to x and simplify where possible:

a) $y = e^{3x}$ b) $f(x) = e^{-2x} + \ln 3x$ c) $y = 5^x$

d) $f(x) = \ln 4x^5$ e) $y = 2^{3x-1}$ **[9]**

5) A curve has the equation $y = \ln x + \frac{3}{x}$. Find the equation of the normal to the curve at $x = 1$, leaving your answer exact. **[5]**

6) Differentiate with respect to x and simplify where possible:

a) $y = (3+2x)^5$ b) $f(x) = (3-2x)^{-4}$ c) $y = (2+3x^2)^3$

d) $f(x) = (x^2+3x+1)^5$ e) $y = 5(x^2-1)^{\frac{1}{2}}$ **[15]**

7) A curve has the equation $y = (e^x + \ln x)^2$. Find the equation of the tangent to the curve at $x = 1$, leaving your answer exact. **[5]**

8) The curve with equation $y = 4 - e^x$ meets the y axis at point P and the x axis at point Q.

a) Find the equation of the normal to the curve at P.

b) Find the equation of the tangent to the curve at Q.

The normal to the curve at P meets the tangent to the curve at Q at the point R. The x coordinate of R is $a\ln 2 + b$ where a and b are rational constants.

c) Show that $a = \frac{8}{5}$.

d) Find the value of b. **[10]**

Total: 60 Marks