30 September 2014 **Derivative Relays**

The answers to each of the following problems is a positive integer.

(1) $[A]$ is the coefficient of $f'(x)g'(x)$ in

$$\frac{d^2}{dx^2}\left(f(x)g(x)\right).$$

(2) $[B]$ is equal to

$$\frac{d}{dx}\left((x-\sqrt{x})(x+\sqrt{x})\right)\Big|_{x=[A]}$$

(3) $[C]$ is equal to

$$\frac{d}{dx}\left(\frac{[B]t+11\sqrt{t}}{t^{1/4}}\right)\Big|_{t=1}$$

(4) If the equation of the line tangent to

$$y=\frac{[C]-3xe^x}{x+e^x}$$

at $x=0$ is $y=mx+b$, then $[D]=-m-b$.

(1) Suppose that $g(x) = xf(x)$ and that $f(3) = 4$ and $f'(3) = -2$. If the equation of the line tangent to $g(x)$ at $x = 3$ is $y = mx + b$ then $[A] = m + b$.

(2) $[B]$ is equal to

$$\frac{d^2}{dx^2}\left(\frac{[A]x^2}{1+x}\right)\Bigg|_{x=1}$$

(3) There are two x-values for which the line tangent to the curve

$$y = [B]\left(\frac{x-1}{x+1}\right)$$

is parallel to the line $x - 2y = 2$. The positive x-value is $[C]$.