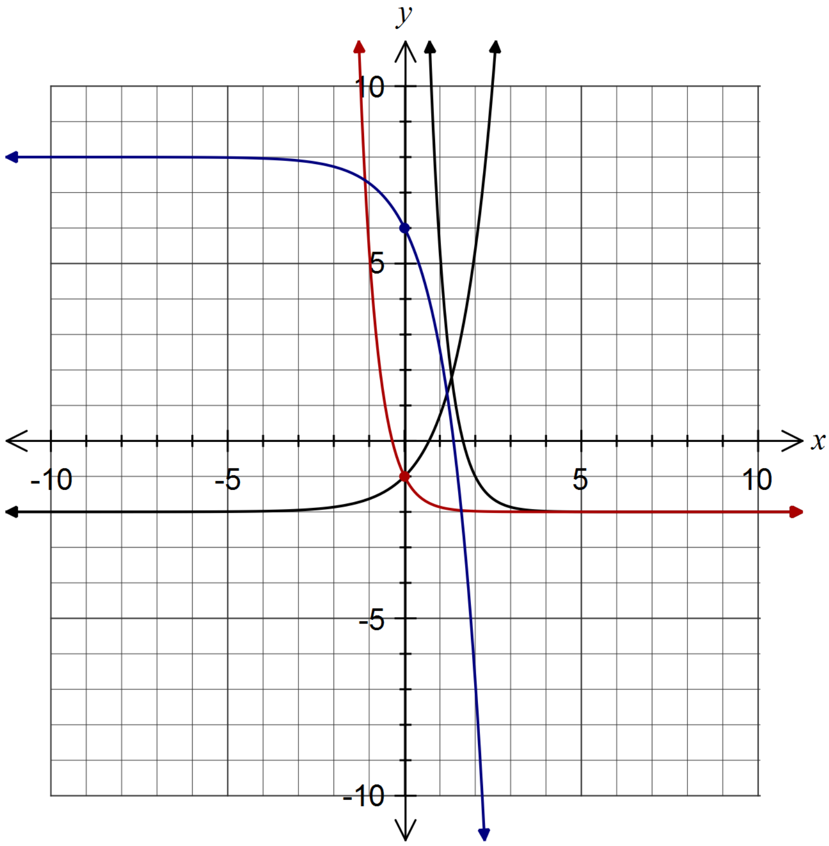
Question 6 **(8 marks)**

The graph of the functions $f(x) = e^x - 2$ and $g(x) = f(a - 2x)$ are shown below.



(a) Determine the value of the constant . (3 marks)

$(0, -1) \rightarrow (2, -1)$

$$\begin{aligned} g(x) &= e^{a-2x} - 2 \\ -1 &= e^{a-2(2)} - 2 \\ e^{a-4} &= 1 \\ a &= 4 \end{aligned}$$

(b) On the same axes, sketch the graphs of

(i) $y = g(x+2)$. (2 marks)

(ii) $y = 4 - 2f(x)$. (3 marks)

Question 7 **(3 marks)**

The derivatives of the sequence $1,\ \binom{n}{1}(-2x)^1,\ \binom{n}{2}(-2x)^2,\ \binom{n}{3}(-2x)^3,\ \ldots,\ \binom{n}{n}(-2x)^n$

are $0,\ \binom{n}{1}(-2),\ \binom{n}{2}(-4)(-2x)^1,\ \binom{n}{3}(-6)(-2x)^2,\ \ldots,\ \binom{n}{n}(-2n)(-2x)^{n-1}$.

When n is a positive even integer, the sum of the series

$$1+\binom{n}{1}(-2x)^1+\binom{n}{2}(-2x)^2+\binom{n}{3}(-2x)^3+\ldots+\binom{n}{n}(-2x)^n=(2x-1)^n.$$

Show that when n is a positive even integer, the sum of the series of derivatives

$$0+\binom{n}{1}(-2)+\binom{n}{2}(-4)(-2x)^1+\binom{n}{3}(-6)(-2x)^2+\ldots+\binom{n}{n}(-2n)(-2x)^{n-1}=\frac{2n}{2x-1}(2x-1)^n.$$

If sum of series is $(2x-1)^n$, then sum of series of derivatives will be $\frac{d}{dx}(2x-1)^n$.

$$\begin{aligned}\frac{d}{dx}(2x-1)^n &= 2n(2x-1)^{n-1}\\ &= 2n(2x-1)^n(2x-1)^{-1}\\ &= \frac{2n}{2x-1}(2x-1)^n\end{aligned}$$

End of questions

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