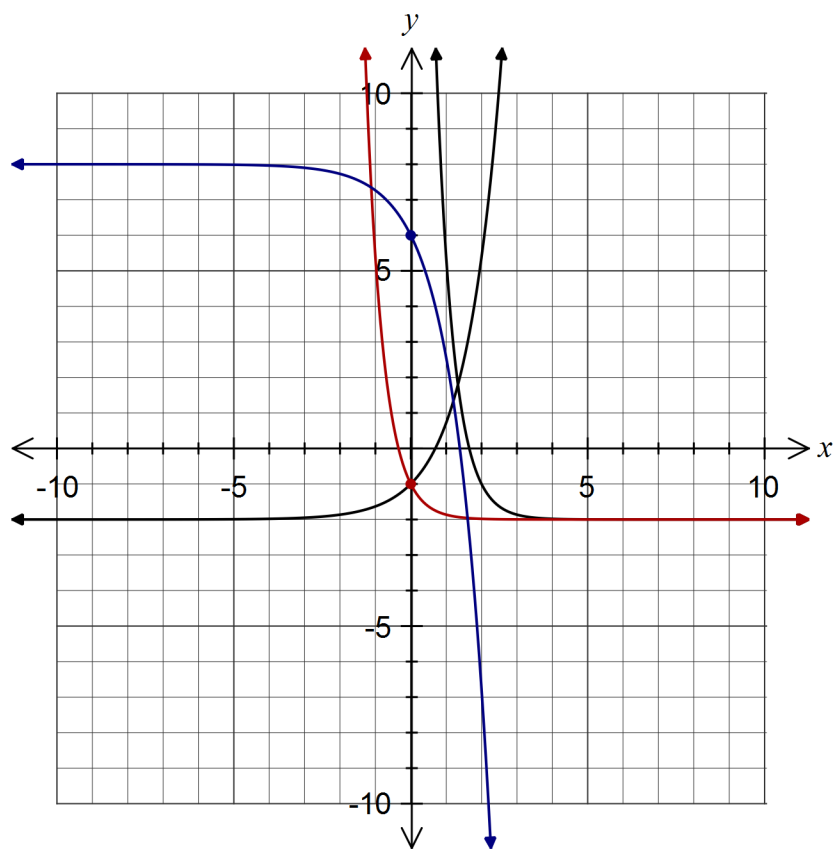


Question 6

(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)

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

$$g(x) = e^{a-2x} - 2$$

$$-1 = e^{a-2(2)} - 2$$

$$e^{a-4} = 1$$

$$a = 4$$

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

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

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

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

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

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

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

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