Transformations and asymptotes of exponential graphs

6 questions | 13 marks

Equivalent correct methods earn the corresponding marks.

1. Find the domain and range of $y = 2^x + 3$. [2 marks]

2^x is defined and positive for all real x.

Answer: Domain $\mathbb{R}$; range $y > 3$.

2. Find the y-intercept of $y = 4(3^{x-1}) - 2$. [2 marks]

At $x = 0$, $\frac{4}{3} - 2 = -\frac{2}{3}$.

Answer: $(0, -\frac{2}{3})$

3. Describe the transformations from $y = 3^x$ to $y = -2(3^{x+1}) + 4$. [2 marks]

The inner $x + 1$ shifts left; the outer -2 stretches and reflects.

Answer: Left 1; vertical stretch factor 2; reflection in the x-axis; up 4.

4. Find the asymptote and range of $y = 6 - 4(0.8)^x$. [2 marks]

Four times the exponential is positive, so subtracting it stays below 6.

Answer: Asymptote $y = 6$; range $y < 6$.

5. Find the x-intercept of $y = 2^{x+1} - 8$. [2 marks]

$2^{x+1} = 8 = 2^3$, so $x + 1 = 3$ and $x = 2$.

Answer: $(2, 0)$

6. Explain why $y = 2^x + 1$ is not the same graph as $y = 2^{x+1}$. [3 marks]

The first adds 1 to every output; the second multiplies 2^x by 2.

They also have different values at $x = 1$: 3 and 4.

Answer: The first has asymptote $y = 1$; the second has asymptote $y = 0$.