Problems of Asymptotes of functions

1) Find out the vertical asymptotes for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = \frac{(x+6)^2}{x+3}$$

2) Find out the vertical asymptotes for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = \frac{x^2-4}{x+3}$$

3) Find out the horizontal asymptotes for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = \frac{5x}{x^2+4}$$

4) Find out the horizontal asymptotes for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = (x-5)\,e^{x-3}$$

5) Find out the oblique asymptotes for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = \frac{x^2-1}{x+4}$$

6) Find out the oblique asymptotes for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = \frac{x^2}{x-1}$$

7) Find out all asymptotes (vertical, horizontal and oblique) for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = \frac{9x-2}{x+4}$$

8) Find out all asymptotes (vertical, horizontal and oblique) for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = \frac{-8x}{x^2+2}$$

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9) Find out all asymptotes (vertical, horizontal and oblique) for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = (1/2)^{-x}$$

10) Find out all asymptotes (vertical, horizontal and oblique) for the graph of the following function and the position of the curve relative to the asymptotes:

$$f(x) = \frac{x^2}{x - 1}$$

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Answers:

1) Vertical asymptote: $x = -3$; $\lim_{x \to -3^-} f(x) = -\infty$, $\lim_{x \to -3^+} f(x) = +\infty$.

2) Vertical asymptote: $x = -3$; $\lim_{x \to -3^-} f(x) = -\infty$, $\lim_{x \to -3^+} f(x) = +\infty$.

3) Horizontal asymptote: $y = 0$. Position of the curve relative to the asymptote:

$f(x)$ is situated below the asymptote if $x \to -\infty$.

$f(x)$ is situated above the asymptote if $x \to +\infty$.

4) Horizontal asymptote: $y = 0$. Position of the curve relative to the asymptote:

$f(x)$ is situated below the asymptote if $x \to -\infty$.

5) Oblique asymptote: $y = x - 4$. Position of the curve relative to the asymptote:

$f(x)$ is situated below the asymptote if $x \to -\infty$.

$f(x)$ is situated above the asymptote if $x \to +\infty$.

6) Oblique asymptote: $y = x + 1$. Position of the curve relative to the asymptote:

$f(x)$ is situated below the asymptote if $x \to -\infty$.

$f(x)$ is situated above the asymptote if $x \to +\infty$.

7) Vertical asymptote: $x = -4$. $\lim_{x \to -4^-} f(x) = +\infty$, $\lim_{x \to -4^+} f(x) = -\infty$.

Horizontal asymptote: $y = 9$. Position of the curve relative to the asymptote:

$f(x)$ is situated above the asymptote if $x \to -\infty$.

$f(x)$ is situated below the asymptote if $x \to +\infty$.

f has no oblique asymptote.

8) f has no vertical asymptote.

Horizontal asymptote: $y = 0$. Position of the curve relative to the asymptote:

$f(x)$ is situated above the asymptote if $x \to -\infty$.

$f(x)$ is situated below the asymptote if $x \to +\infty$.

f has no oblique asymptote.

9) f has no vertical asymptote.

Horizontal asymptote: $y = 0$. Position of the curve relative to the asymptote:

$f(x)$ is situated above the asymptote if $x \to -\infty$.

f has no oblique asymptote.

10) Vertical asymptote: $x = 1$; $\lim_{x \to 1^-} f(x) = -\infty$, $\lim_{x \to 1^+} f(x) = +\infty$.

f has no horizontal asymptote.

Oblique asymptote: $y = x + 1$. Position of the curve relative to the asymptote:

$f(x)$ is situated below the asymptote if $x \to -\infty$.

$f(x)$ is situated above the asymptote if $x \to +\infty$.