Part A - Multiple Choice

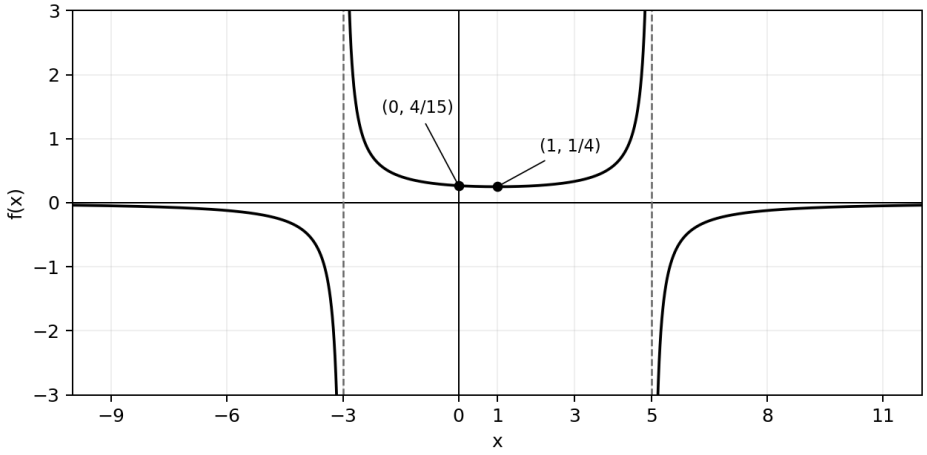
Question	Answer	Question	Answer
1	A	6	A
2	D	7	B
3	B	8	D
4	D	9	C
5	C		

Part B - Applications

1a. $f(x) = -4/(x^2 - 2x - 15)$

Feature	Answer
i) Domain	$x \in \mathbb{R}, x \neq -3, 5$
ii) Range	$(-\infty, 0) \cup [1/4, \infty)$
iii) Intercepts	x-intercepts: none. y-intercept: (0, 4/15).
iv) Vertical asymptotes	$x = -3$ and $x = 5$. As $x \to -3^-$, $f(x) \to -\infty$; as $x \to -3^+$, $f(x) \to +\infty$. As $x \to 5^-$, $f(x) \to +\infty$; as $x \to 5^+$, $f(x) \to -\infty$.
v) Horizontal asymptote	$y = 0$. As $x \to -\infty$ and $x \to +\infty$, $f(x) \to 0$ from below.

1b. Graph:



Part B - Applications (continued)

2. $(x^2 - 16x - 1) / [4x(x - 4)(x + 1)]$
Restrictions: **$x \neq -1, 0, 4, 5$.**

3. $x = 7 \pm \sqrt{55}$
Approximately **$x = 14.4$ or $x = -0.4$.**

4. $-1/2 \leq x \leq 2$

Part C - Communication

a) 2016.

b) Yes. The population exceeds 40,000 when $t > 20$ (after the start of 2020), and approaches 45,000.

c) Domain: **$t \in [0, \infty)$**.
Range: **$P(t) \in [15, 45)$**, in thousands ($15{,}000 \leq$ population $< 45{,}000$).

Part D - Thinking, Inquiry and Problem Solving

$f(x) = -2/(3x^2)$, with $x \neq 0, 4$.

Feature	Answer
Domain	$x \in \mathbb{R}, x \neq 0, 4$
Range	$(-\infty, 0)$
Intercepts	No x-intercepts or y-intercept.
Vertical asymptote	$x = 0$. As $x \to 0^-$ and $x \to 0^+$, $f(x) \to -\infty$.
Horizontal asymptote	$y = 0$. As $x \to -\infty$ and $x \to +\infty$, $f(x) \to 0$ from below.
Hole	$(4, -1/24)$. As $x \to 4^-$ and $x \to 4^+$, $f(x) \to -1/24$.

Graph:

