1. The graph of $y = \dfrac{3x+9}{x^2-9}$ has

(A) a vertical asymptote a $x = 3$
(B) a horizontal asymptote at $y = \dfrac{1}{3}$
(C) a removable discontinuity at $x = 3$
(D) a vertical asymptote a $x = -3$
(E) none of these

y has a V.A. @ x = 3
b/c $\lim_{x\to 3^-} y = -\infty$
$\lim_{x\to 3^+} y = \infty$

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2. Identify the vertical asymptotes for $f(x) = \dfrac{x^2+3x-4}{x^2+x-2}$

(A) $x = -2, x = 1$
(B) $x = -2$
(C) $x = 1$
(D) $y = -2, y = 1$
(E) $y = -2$

V.A. @ x = -2
b/c $\lim_{x\to -2^-} f(x) = -\infty$
and $\lim_{x\to -2^+} f(x) = \infty$

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3. How many vertical asymptotes exist for the function $f(x) = \dfrac{1}{2\sin^2 x - \sin x - 1}$ in the open interval $0 < x < 2\pi$?

(A) 0 **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 4

$(2\sin x + 1)(\sin x - 1) = 0$
$\sin x = -\frac{1}{2}$ $\sin x = 1$
$x = \frac{7\pi}{6}, \frac{11\pi}{6}$ $x = \pi/2$

$(\sin x)^2 = \sin^2 x$

There are 3 V.A. @ $x = \pi/2$, $x = \frac{7\pi}{6}$, and $x = \frac{11\pi}{6}$

b/c
$\lim_{x\to \frac{\pi}{2}^-} f(x) = -\infty$ $\lim_{x\to \frac{\pi}{2}^+} f(x) = -\infty$
$\lim_{x\to \frac{7\pi}{6}^-} f(x) = -\infty$ $\lim_{x\to \frac{7\pi}{6}^+} f(x) = \infty$
$\lim_{x\to \frac{11\pi}{6}^-} f(x) = \infty$ $\lim_{x\to \frac{11\pi}{6}^+} f(x) = -\infty$

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4. $\lim_{x\to 0} \dfrac{\tan\left(\frac{\pi}{6}+x\right) - \tan\left(\frac{\pi}{6}\right)}{x} =$

Let $f(x) = \dfrac{\tan(\frac{\pi}{6}+x) - \tan\frac{\pi}{6}}{x}$

(A) $\frac{\sqrt{3}}{3}$ **(B)** $\frac{4}{3}$ **(C)** $\sqrt{3}$ **(D)** 0 **(E)** $\frac{3}{4}$

x	-.1	-.01	-.001	0	.001	.01	.1
f(x)	1.265	1.326	1.333		1.334	1.341	1.420

$\lim_{x\to 0} f(x) = 4/3$ b/c $\lim_{x\to 0^-} f(x) = 1.333$ $\lim_{x\to 0^+} f(x) = 1.333$