Write the expression in lowest terms and state any restrictions on the variable.

1. $\dfrac{p+3}{p}+\dfrac{1+p^2}{p^2}$

2. $\dfrac{2x^2-7x-15}{4x^3+8x^2-5x}\bullet\dfrac{2x^2-x-15}{2x^2+3x}$

3. Rationalize the denominator of $\dfrac{7\sqrt{2}}{\sqrt{2}+3}$.

4. Solve the equation $\dfrac{3}{x-1}+\dfrac{2x+8}{x+3}=\dfrac{1}{x^2+2x-3}$ algebraically, then check with your CAS.

5. Solve the equation $\dfrac{5}{p+2}-\dfrac{p+3}{2p-1}=\dfrac{\pm 5}{2p^2+3p-2}$ algebraically, then check with your CAS.

Use the given identity to find $\sin\left(\dfrac{5\pi}{12}\right)$.

6. $\sin(\alpha-\beta)=\sin\alpha\cos\beta-\cos\alpha\sin\beta$

7. $\cos 2x=1\pm 2\sin^2 x$

8. Use the given identity to find $\cos\left(\dfrac{11\pi}{12}\right)$.
   $\cos(\alpha+\beta)=\cos\alpha\cos\beta-\sin\alpha\sin\beta$

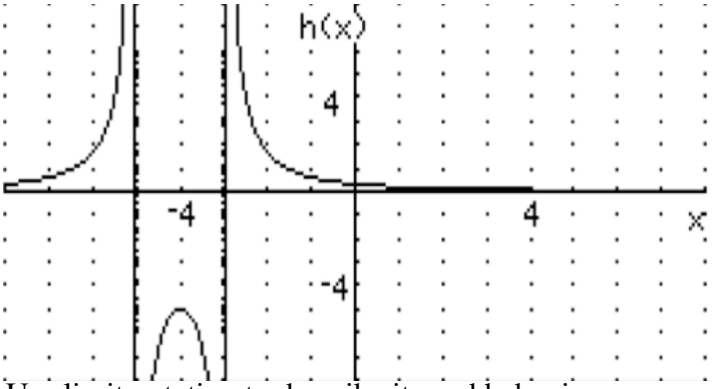
9. Identify as rational or irrational the number $34.5462313131313131\ldots$ Explain your answer.

10. Identify as rational or irrational the number $102.0304050607080901001101201 30\ldots$, where consecutive integers are separated by a 0. Explain your answer.

11. Consider the function f defined by $f(x) = \dfrac{2x - 8x^3}{6x^2 + 5x - 4}$.
State the domain of f.

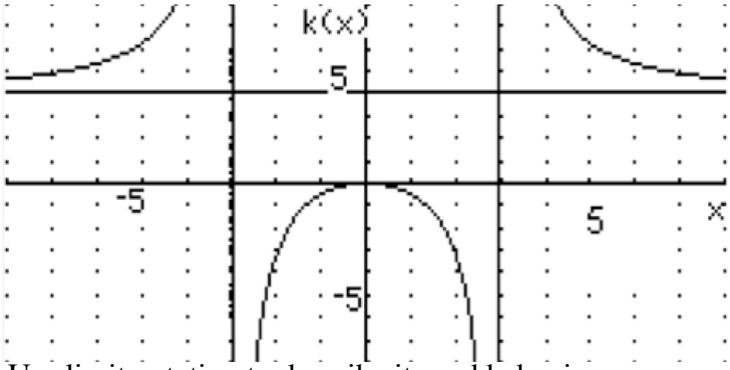
12. Consider the function h defined by $h(x) = \dfrac{9x^3 - 4x}{12x^2 - 5x - 2}$.
Rewrite $h(x)$ in lowest terms.

13. Consider the function h graphed below.



Use limit notation to describe its end behavior.

14. Consider the function k graphed below.



Use limit notation to describe its end behavior.

15. Find a value of k for which the function Q with $Q(x) = \dfrac{(kx + 2)}{(3x + 2)(7x + 2)}$ has a removable discontinuity at $x = \dfrac{\pm 2}{3}$ and an essential discontinuity at $x = \dfrac{\pm 2}{7}$.

16. Prove the identity $\tan x + \cot x = \sec x \csc x$ and identify its domain.

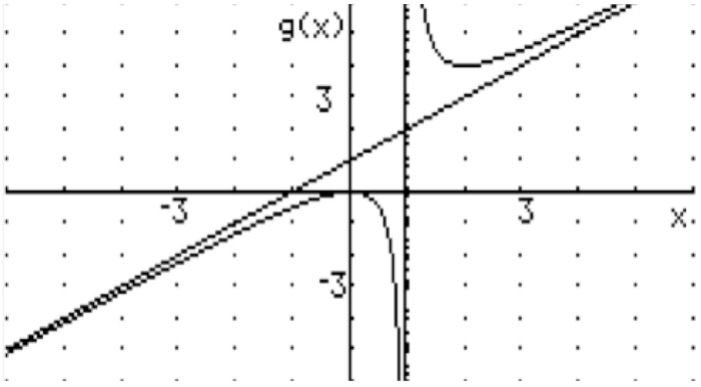
17. Prove the identity $\sec x + \cot x \csc x = \sec x \csc^2 x$ and identify its domain.

18. For Hera's fourteenth birthday party, her mother invited *p* people and made 3 sheet cakes: one white cake, one lemon cake, and one pound cake. She cuts the cakes into equally-sized pieces, according to how many people wanted to try that cake.
If $(p \pm 3)$ people want a piece of white cake, $(p \pm 1)$ people want a piece of lemon cake, and $(p \pm 4)$ people want a piece of pound cake, write a rational expression in lowest terms for the amount of cake someone eats if he or she has a piece of all three cakes. Express your answer as a fraction of one cake.

19. A Boeing 757 flew round-trip between Phoenix and Chicago, which are 1449 miles apart. The average speed of the plane was 437 miles per hour. The wind was blowing at 43 miles per hour from Chicago toward Phoenix. Write an equation that you could use to calculate the plane's speed relative to still air.

20. A kayaker made a round trip between two towns across a lake.
The towns were 14 miles apart. Her average speed was 2.2 miles per hour. The wind created a current of 0.5 miles per hour from the first town to the second.
$\frac{14}{r+0.5} + \frac{14}{r-0.5} = \frac{28}{2.2}$ is an equation you could use to calculate her speed relative to still air. Use a CAS to solve this equation. What does the CAS return, and what does it mean?

21. Use the graph of the function *g* to find the limit.



$\lim_{x \to 1^+} g(x)$

22. Use the graph of the function g to find the limit.

$$\lim_{x \to \pm\infty} g(x)$$

23.

$$\lim_{x \to \infty} g(x)$$

24. Use a graphing utility to conjecture whether the equation $\sin\left(\frac{\pi}{2} - x\right) = \sin\left(x - \frac{\pi}{2}\right)$ is an identity, and explain how you made your decision.