Use the following information to answer question 11.

In parallel circuits, the total resistance of a circuit is determined by using the formula $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$, where R_T is the total resistance, R_1 is the resistance of one branch of the parallel circuit, and R_2 is the resistance of the other branch of the parallel circuit.

In a particular parallel circuit, one branch has 5 Ω more resistance than the other. This can be modelled by the equation

$$\frac{1}{R_T} = \frac{1}{x} + \frac{1}{x+5}$$

where x is the resistance of one branch of the parallel circuit, in ohms.

11. If the total resistance of this circuit, R_T, is 6 Ω, then the resistance of the two branches of the circuit are

A. 3 Ω and 3 Ω

B. 3 Ω and 8 Ω

C. 5 Ω and 10 Ω

***D.** 10 Ω and 15 Ω

12. Determine the solution to each equation.

a. $\frac{5x-1}{4x+11} = \frac{3}{4}$

b. $\frac{3}{x} + \frac{5}{3} = 10$

c. $\frac{3x}{x-1} - \frac{4}{x} = 3$

SE **d.** $\frac{2x}{x+3} + \frac{x}{x-3} = \frac{18}{x^2-9}$

Possible Solutions:

a.
$$\begin{aligned}\frac{5x-1}{4x+11} &= \frac{3}{4}\\ 4(5x-1) &= 3(4x+11)\\ 20x-4 &= 12x+33\\ 8x &= 37\\ x &= \frac{37}{8}\end{aligned}$$

b.
$$\begin{aligned}\frac{3}{x}+\frac{5}{3} &= 10\\ 9+5x &= 30x\\ 9 &= 25x\\ x &= \frac{9}{25}\end{aligned}$$

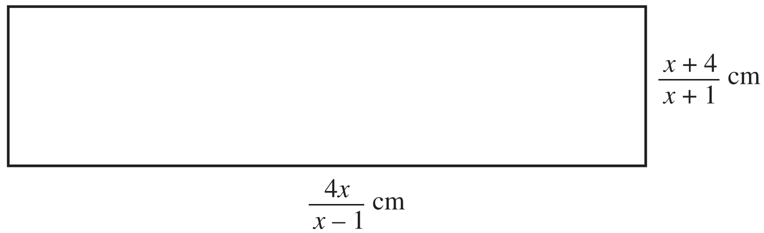
c.
$$\begin{aligned}\frac{3x}{x-1}-\frac{4}{x} &= 3\\ 3x(x)-4(x-1) &= 3x(x-1)\\ 3x^2-4x+4 &= 3x^2-3x\\ -x &= -4\\ x &= 4\end{aligned}$$

d.
$$\begin{aligned}\frac{2x}{x+3}+\frac{x}{x-3} &= \frac{18}{x^2-9}\\ 2x(x-3)+x(x+3) &= 18\\ 2x^2-6x+x^2+3x &= 18\\ 3x^2-3x-18 &= 0\\ x^2-x-6 &= 0\\ (x-3)(x+2) &= 0\\ x &= 3,\ x=-2\end{aligned}$$

However, x can not equal 3 because it makes one of the denominators in the rational equation equal to 0. Since $x = 3$ is rejected, the only solution is $x = –2$.

Use the following information to answer question 13.

The dimensions of a rectangle are represented by rational expressions, where $x > 1$, as shown in the diagram below.



SE **13.** If the area of the rectangle is 16 m^2, determine the dimensions of the rectangle to the nearest centimetre.

Possible Solution:

$$\frac{4x}{x-1} \bullet \frac{x+4}{x+1} = 16$$

$$\begin{aligned} 4x^2 + 16x &= 16x^2 - 16 \\ 0 &= 12x^2 - 16x - 16 \\ 0 &= 4(3x^2 - 4x - 4) \\ 0 &= 4(3x + 2)(x - 2) \\ x &= \frac{-2}{3}, 2 \end{aligned}$$

Since $x > 1$, the solution to the equation is $x = 2$.

The length of the rectangle is $\frac{4 \bullet 2}{2 - 1} = 8$ cm.

The width of the rectangle is $\frac{2 + 4}{2 + 1} = 2$ cm.

Use the following information to answer question 14.

A student solved a rational equation using the steps shown below.

$$\frac{x}{x+1} - \frac{2}{x-1} = 2$$

Step 1 $x(x-1) - 2(x+1) = 2$

Step 2 $x^2 - x - 2x - 2 = 2$

Step 3 $x^2 - 3x - 4 = 0$

Step 4 $(x-4)(x+1) = 0$

Step 5 $x = -1, 4$

14. **a.** Identify the errors made in the steps shown above.

Possible Solution:
Step 1: The student did not multiply the right-hand side of the equation by the common denominator.

Steps 2, 3, and 4: The student has carried the error from Step 1 through. (Note: If there had not been an error in Step 1, these steps would be correct.)

Step 5: Again, the student has carried the error from Step 1 through. However, the student has also made an error by not rejecting the extraneous solution of $x = -1$.

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b. Make the corrections necessary to obtain the solution to the equation.

Possible Solution:

Step 1 $x(x-1) - 2(x+1) = 2(x+1)(x-1)$

Step 2 $x^2 - x - 2x - 2 = 2x^2 - 2$

Step 3 $x^2 + 3x = 0$

Step 4 $x(x+3) = 0$

Step 5 $x = -3, 0$

Use the following information to answer question 15.

Elliott Nicholls currently holds the world record for the fastest text messaging while blindfolded. He was able to text 160 characters in a time that was 40 seconds less than the previous world record holder's time. Elliott's average rate of texting was 1.6 characters/second faster than the previous world record holder's average rate of texting. The chart below summarizes this information.

	Number of Characters	**Time Taken (s)**	**Average Rate of Texting (characters/s)**
Previous record holder	160	x	$\frac{160}{x}$
Elliott	160	$x - 40$	$\frac{160}{x-40}$

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15. **a.** Write an equation that models the relationship between the average rates of texting for Elliott and the previous world record holder.

Possible Solution:

$$\frac{160}{x-40} - \frac{160}{x} = 1.6$$

b. Describe the restrictions on the value of x in this context.

Possible Solution:
The value of x represents the time required to text 160 characters. Since Elliot beat the previous world record holder's time, x, by 40 s, the stated solution for x must be a positive value greater than 40 s.

c. The equation can be simplified to obtain $1.6x^2 - 64x - 6\,400 = 0$. Solve this equation. Express your solution to the nearest tenth of a second.

Possible Solution:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{64 \pm \sqrt{(-64)^2 - 4(1.6)(-6400)}}{2(1.6)}$$

$$x = \frac{64 \pm \sqrt{45056}}{3.2}$$

$$x \approx 86.3,\ x \approx -46.3$$