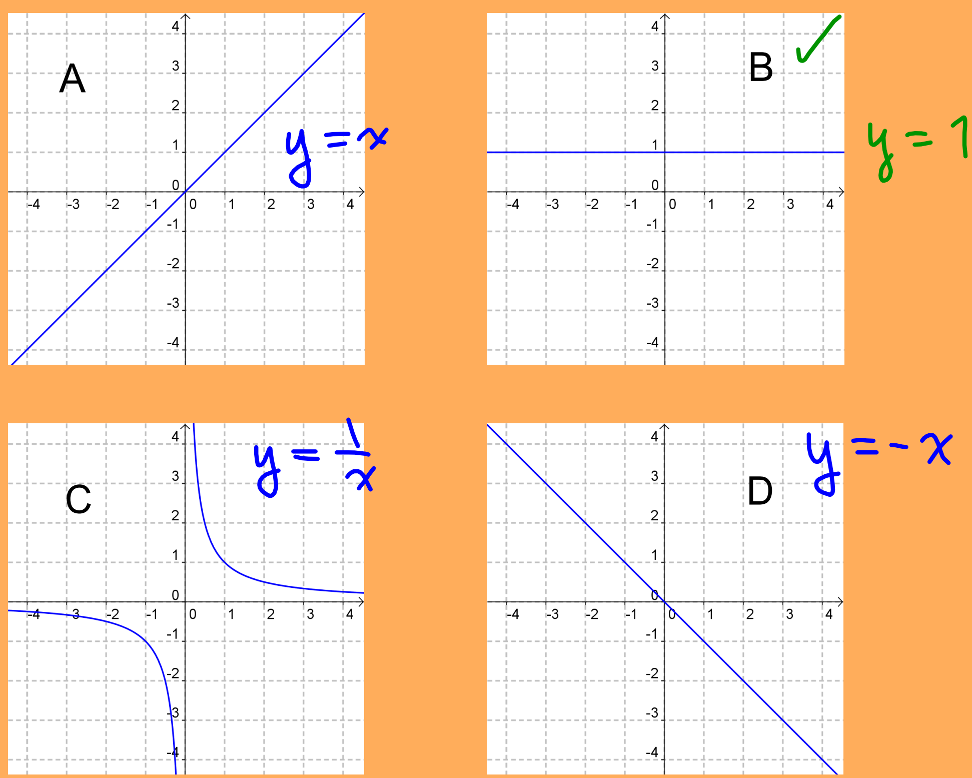
# Unit 3 - Rational Expressions

## Equivalent Rational Expressions

Feb 12-9:14 PM

1. Which graph shows the relation $y = 1$?

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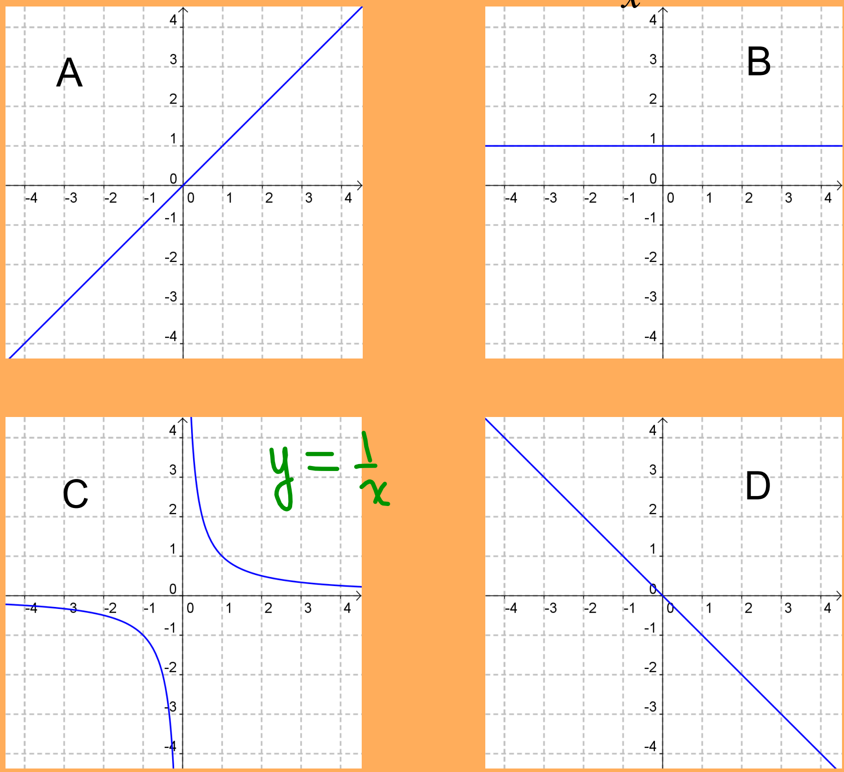
2. Which graph shows the relation $y = \frac{1}{x}$?

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3. Consider the relation: $y = \frac{x}{x}$

If you compared the graph of $y = \frac{\cancel{x}^{1}}{\cancel{x}_{1}}$ to $y = 1$, they would be:

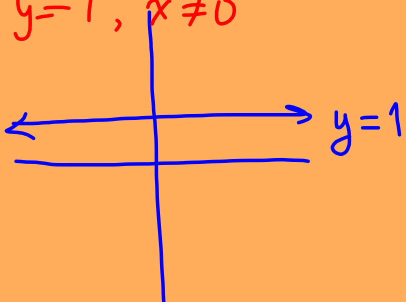
$y = 1,\ x \neq 0$

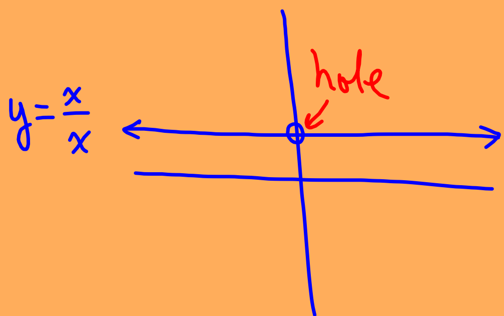
A) always the same

✓B) mostly the same

C) sometimes the same

D) never the same

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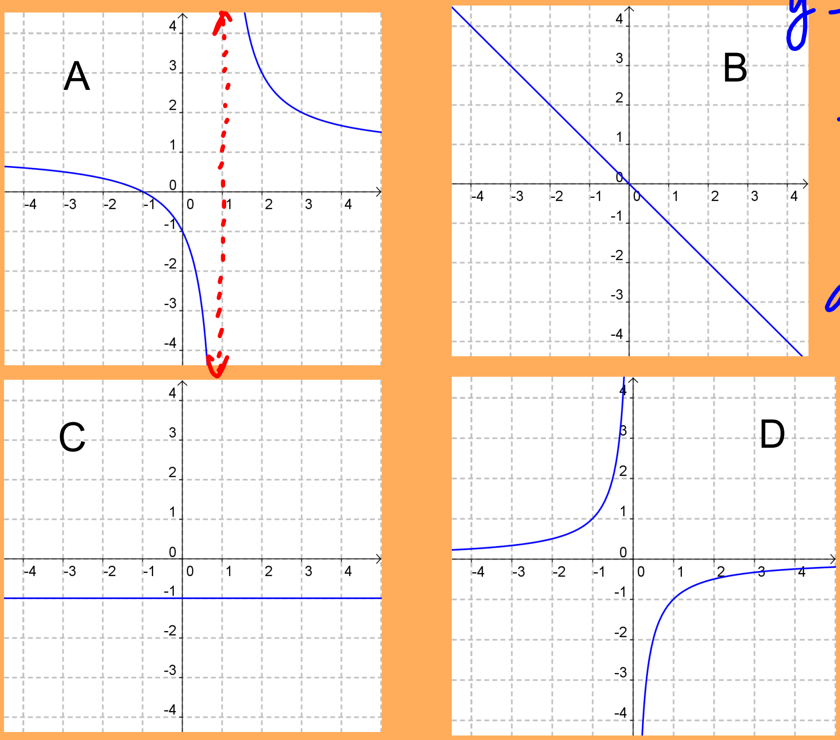
4. Which graph shows the relation $y = \dfrac{x+1}{x-1}$ ?

$x = 1$

$y = \dfrac{1+1}{1-1}$

$= \dfrac{2}{0}$

Vert. asymptote

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See handout

For each of the following <u>rational</u> expressions:

1. Determine an equivalent expression algebraically.
   (Hint: Try common factors)

2. Graph the expression.

3. Your expressions seem to be equivalent, yet they also have some very important differences. Discuss how you would distinguish between the original expression and your new expression
(a) algebraically. → state restriction
(b) graphically. → graph a hole(s)

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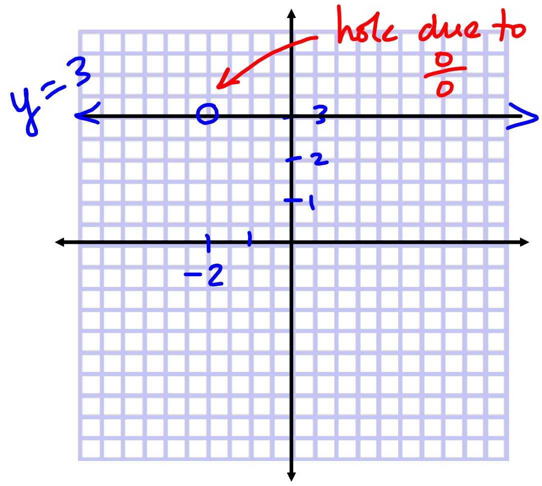
A. $y = \dfrac{3x+6}{x+2}$

| $x$ | $y$ |
|---|---|
| $-5$ | $3$ |
| $-4$ | $3$ |
| $-3$ | $3$ |
| $-2$ | $\frac{0}{0}$ → undefined |
| $-1$ | $3$ |
| $0$ | $3$ |
| $1$ | $3$ |
| $2$ | $3$ |
| $3$ | $3$ |
| $4$ | $3$ |
| $5$ | $3$ |




$$y = \frac{3x+6}{x+2}$$

$$= \frac{3\cancel{(x+2)}^{1}}{\cancel{(x+2)}_{1}}$$

$$= 3, \quad x+2 \neq 0$$

$$x \neq -2$$

let $z = x+2$

$$y = \frac{3\cancel{z}^{1}}{\cancel{z}_{1}}$$

$$= 3, \quad z \neq 0$$

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B. $y = \dfrac{2x^2+10x}{3x+15}$

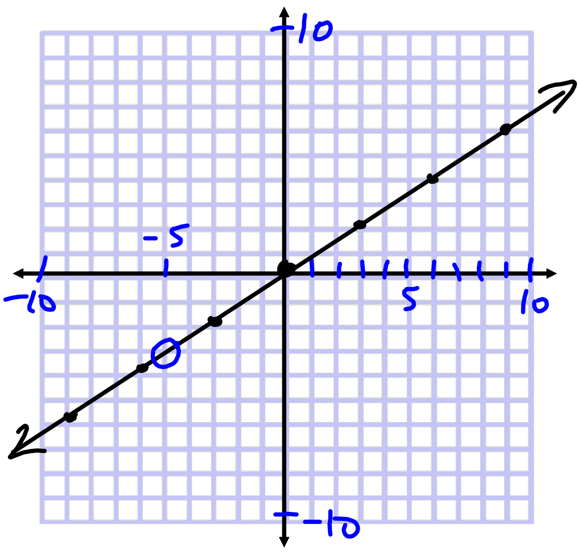
$$y = \frac{2x\cancel{(x+5)}^{1}}{3\cancel{(x+5)}_{1}}$$

$$y = \frac{2x}{3}, \quad x \neq -5$$

OR

$$y = \frac{2}{3}x + 0$$

$$m = \frac{2}{3} = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x}$$




hole at $\left(-5, \frac{-10}{3}\right)$

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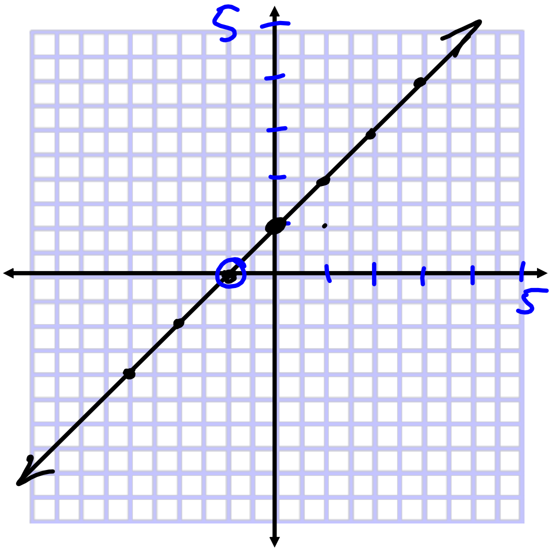
C. $y = \dfrac{x^2+2x+1}{x+1}$

$y = \dfrac{(x+1)\cancel{(x+1)}^{1}}{\cancel{(x+1)}_{1}}$

$y = 1x + 1$, $x \neq -1$

$m = \dfrac{1}{1}$   y-int




Where is the hole? $\longrightarrow$ $P(x, y)$

$(-1, 0)$

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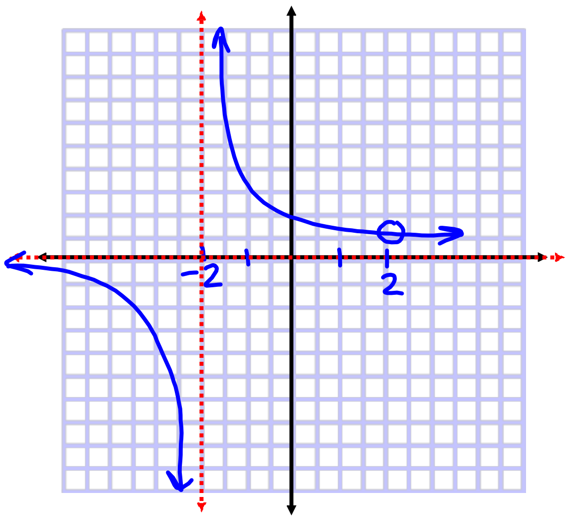
D. $y = \dfrac{x-2}{x^2-4}$

$y = \dfrac{\cancel{(x-2)}^{1}}{{}_{1}\cancel{(x-2)}(x+2)}$

$y = \dfrac{1}{x+2}$, $x \neq 2$
hole

$x \neq -2$
vertical asymptote




$x^2 + 0x - 4$
S 0
P −4
I −2, 2

hole at $(2, \frac{1}{4})$

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List some mathematical techniques used when determining equivalent expressions for rational functions:

- factoring quadratics
- common factors
- division

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When graphing rational functions, what noteworthy features may appear on the graph?

* holes when we have $\frac{0}{0}$

also asymptotes

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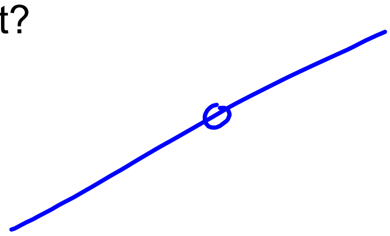
The graphs of our equivalent expressions look the same, yet they are also different. How can we tell the graphs apart?

holes



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How can we distinguish between the original and equivalent relations using some written notation?

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Assigned Work:

p.40 # 1 - 3 (odd) (fundamentals - optional) c

~~# 4 - 6~~ (odd), 8, 13, 15

# 16 Se a

WS F, , G

WS F. $y = \frac{2x^2 - x - 6}{3x^2 - 7x + 2}$

$= \frac{(2x+3)\cancel{(x-2)}}{(3x-1)\cancel{(x-2)}}$

$y = \frac{2x+3}{3x-1}, x \neq 2$

$3x - 1 = 0$

$3x = 1$

VA : $x = \frac{1}{3}$

$y(3x-1) = 2x+3$

$3xy - y = 2x+3$

$3xy - 2x = y + 3$

$x(3y-2) = y+3$

$x = \frac{y+3}{3y-2}$

HA : $3y - 2 = 0$

$3y = 2$

$y = \frac{2}{3}$

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1(c) $\frac{10y^4 + 5y^3 - 15y^2}{5y}$

$= \frac{\cancel{5}y^{\cancel{2}\,1}(2y^2 + y - 3)}{\cancel{5}\cancel{y}_1}$

$= y(2y^2 + y - 3)$

$\frac{y^2}{y} = \frac{\cancel{y}^1 \cdot y}{\cancel{y}_1}$

$= y$

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5 ae

(a)
$$\frac{1-x}{x-1}$$
$$= \frac{-1x+1}{x-1}$$
$$= \frac{-1\cancel{(x-1)}}{\cancel{(x-1)}}$$
$$= -1, \; x = 1$$

(e)
$$\frac{x^2-1}{1-x^2}$$
$$= \frac{(x-1)\cancel{(x+1)}}{(1-x)\cancel{(1+x)}}$$
$$= \frac{x-1}{-x+1}, \; x \neq -1$$
$$= \frac{1\cancel{(x-1)}}{-1\cancel{(x-1)}}, \; x \neq -1$$
$$= -1, \; x \neq -1, x \neq 1$$

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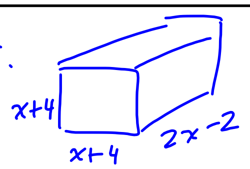
15.




$$\frac{z^2}{z} = \frac{z \cdot z}{z} = z$$

$$\frac{V}{SA} = \frac{(x+4)(x+4)(2x-2)}{2(x+4)^2 + 4(x+4)(2x-2)}$$
$$= \frac{(x+4)(x+4)(2)(x-1)}{2(x+4)\left((x+4)+2(1)(2)(x-1)\right)}$$
$$= \frac{\cancel{2}(x+4)(x-1)}{\cancel{2}(x+4+4x-4)}, \; x \neq -4$$
$$= \frac{(x+4)(x-1)}{5x}, \; x \neq -4$$
$$= \frac{x^2+3x-4}{5x}, \; x \neq -4$$

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