Honors Common Core III
Test Review: Rational Functions

Name: Key
Date :

1.

Y-intercept: (0,3)

X-intercept: (-12,0) and (1,0)

Original Equation → $\frac{x^2+11x-12}{x-4} = \frac{(x+12)(x-1)}{(x-4)}$ ← Factored Form

Horizontal Asymptote: no horizontal

Vertical Asymptote: $x=4$

Domain: $\mathbb{R}$, $x \neq 4$

Hole: none

2.

Y-intercept: none

X-intercept: (1/2,0)

Original Equation → $\frac{2x^2-x}{x^2-8x} = \frac{\cancel{x}(2x-1)}{\cancel{x}(x-8)}$ ← Factored Form

Horizontal Asymptote: $y=2$

Vertical Asymptote: $x=8$

Domain: $\mathbb{R}$, $x \neq 0$ or 8

Hole: $x=0$

$y = \frac{1}{x}$

Function	Transformation	Domain	Vert. Asymp.	Horiz. Asymp
3. $y=\frac{3}{x+1}$	left 1 vertical stretch by 3	$\mathbb{R}$, $x \neq -1$	$x=-1$	$y=0$
4. $y=\frac{-1}{x}+4$	reflect over x-axis up 4	$\mathbb{R}$, $x \neq 0$	$x=0$	$y=4$

Simplify.

5. $\frac{x^2+2x+1}{2x^2+3x+1} = \frac{x+1}{2x+1}$

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

6. $\frac{x^2-4}{x^2-4x+4} \cdot \frac{2x-1}{x+2} = \frac{2x-1}{x-2}$

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

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7. Simplify $\dfrac{\dfrac{x^2-1}{2x^2-x-1}}{\dfrac{x^2-4}{2x^2-3x-2}}$ $= \dfrac{x+1}{x+2}$

8 $\dfrac{\dfrac{1}{x+6}+\dfrac{1}{x+2}}{\dfrac{x^2+11x+28}{x^2+8x+12}}$ $= \dfrac{2}{x+7}$

Solve the equations.

9. $\dfrac{1}{n+3}+\dfrac{5}{n^2-9}=\dfrac{2}{n-3}$

$n=-4$

10. $\dfrac{12x+19}{x^2+7x+12}-\dfrac{3}{x+3}=\dfrac{5}{x+4}$

$x=2$

11. $\sqrt[3]{x+40}=-5$

$x=-165$

12. $\sqrt{3x-2}=1+\sqrt{2x-3}$

$x=2$ or 6

13. The senior class is sponsoring a dinner. The cost of catering the dinner is \$9.95 per person plus an \$18 delivery charge.
   a. Write a rational function that gives the average cost per person. $y=\dfrac{9.95x+18}{x}$
   b. Graph the function and use it to estimate the number of people needed to lower the cost to \$11 per person.

14. Rosita can wax her car in 2 hours or 120 minutes. When she works together with Helga, they can wax the car in 45 minutes. How long would it take Helga, working by herself, to wax the car?

$x=72$

15. If y varies directly as x and y = 18 when x = 15, find y when x = 20.

$y=24$

16. Suppose y varies jointly as x and z. Find y when x = 9 and z = -5, if y = -90 when z = 15 and x = -6.

$y=-45$

17. If y varies inversely as x and y = -14 when x = 12, find x when y = 21.

$x=-8$

18. State whether the following equation represents *direct, joint, or inverse* variation.

Then name the constant of variation. $\dfrac{C}{d}=\pi$

$k=\pi$

$C=d\pi$

$y=x\cdot k$

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1.
Fill in each box:

Y-intercept	X-intercept

Original Equation → $\dfrac{x^2+11x-12}{x-4} = \dfrac{\quad}{\quad}$ Factored Form

Horizontal Asymptote	Vertical Asymptote	Domain	Hole

2.

Y-intercept	X-intercept

Original Equation → $\dfrac{2x^2-x}{x^2-8x} = \dfrac{\quad}{\quad}$ Factored Form

Horizontal Asymptote	Vertical Asymptote	Domain	Hole

Function	Transformation	Domain	Vert. Asymp.	Horiz. Asymp
$y=\dfrac{3}{x+1}$				
$y=\dfrac{-1}{x}+4$				

Simplify.

5. $\dfrac{x^2+2x+1}{2x^2+3x+1}$

6. $\dfrac{x^2-4}{x^2-4x+4}\cdot\dfrac{2x-1}{x+2}$

(7) $\frac{(x+1)(x-1)}{(2x+1)(x-1)} \cdot \frac{(2x+1)(x-2)}{(x+2)(x-2)} = \frac{x+1}{x+2}$

(8) $\frac{\frac{(x+2)}{(x+2)} \cdot \frac{1}{x+6} + \frac{1}{(x+2)} \cdot \frac{(x+6)}{(x+6)}}{\frac{(x+7)(x+4)}{(x+6)(x+2)}} = \frac{\frac{(x+2)+(x+6)}{(x+2)(x+6)}}{\frac{(x+7)(x+4)}{(x+2)(x+6)}} = \frac{2(x+4)}{(x+7)(x+4)} = \frac{2}{x+7}$

LCD

$(x+6)(x+2)$

(9) $\frac{1}{n+3} \cdot \frac{n-3}{n-3} + \frac{5}{(n+3)(n-3)} = \frac{2}{n-3} \cdot \frac{n+3}{n+3}$

LCD

$(n+3)(n-3)$

* Ditch the denominators!

$n-3+5 = 2(n+3) \longrightarrow n+2 = 2n+6 \longrightarrow n=-4$

(10) $\frac{12x+19}{x^2+7x+12} - \frac{3}{x+3} \cdot \frac{(x+4)}{(x+4)} = \frac{5}{x+4} \cdot \frac{(x+3)}{(x+3)} \longrightarrow 12x+19-3(x+4) = 5(x+3)$

$(x+3)(x+4)$

$12x+19-3x-12 = 5x+15$

$9x+7 = 5x+15$

$4x = 8$

$x = 2$

(11) $\left(\sqrt[3]{x+40}\right)^3 = (-5)^3$

$x+40 = -125$

$x = -165$

(12) $\left(\sqrt{3x-2}\right)^2 = \left(1+\sqrt{2x-3}\right)^2$

$3x-2 = 1 + 2\sqrt{2x-3} + 2x-3$

$(x\ )^2 = \left(2\sqrt{2x-3}\right)^2$

$x^2 = 4 \cdot (2x-3)$

$x^2 = 8x-12$

$x^2-8x+12=0 \quad (x-6)(x-2)=0$

$x = 2$ or 6

(13)

a) $A = \frac{9.95x+18}{x}$

b)

(14)

rate × time = work

Rosita $\frac{1}{120} \cdot 45 = \frac{45}{120}$

Helga $\frac{1}{x} \cdot 45 = \frac{45}{x}$

$\frac{45}{120} + \frac{45}{x} = 1$

$\frac{x}{x} \cdot \frac{3}{8} + \frac{45}{x} \cdot \frac{8}{8} = 1 \cdot \frac{8x}{8x}$

$3x + 360 = 8x$

$x = 72$

(15) $y = Kx$

$18 = K \cdot 15$

$\frac{6}{5} = K$

$y = \frac{6}{5} \cdot 20$

$y = 24$

(16) $y = K \cdot xz$

$-90 = K \cdot -6 \cdot 15$

$K = 1$

$y = 1(9)(-5)$

$= -45$

(17) $y = \frac{K}{x}$

$-14 = \frac{K}{12}$

$K = -168$

$21 = \frac{-168}{x}$

$x = -8$

(18) $\frac{C}{d} = \pi$

$C = d\pi$

$\boxed{\times \text{direct}}$

(10) $\frac{12x+19}{(x+3)(x+4)} - \frac{3}{x+3} = \frac{5}{x+4}$

(12) $\sqrt{3x-2} = 1 + \sqrt{2x-3}$

$3x-2 = 1 + 2\sqrt{2x-3} + 2x-3$

$3x-2 = 2x-2 + 2\sqrt{2x-3}$

$(x)^2 = (2\sqrt{2x-3})^2$

$x^2 = 4(2x-3)$

$x^2 = 8x-12$

$x^2 - 8x + 12 = 0$

$(x-6)(x-2) = 0$

$x = 6 \quad x = 2$

✓ ✓

$(1+\sqrt{2x-3})(1+\sqrt{2x-3})$

	1	$+\sqrt{2x-3}$
1	1	$\sqrt{2x-3}$
$\sqrt{2x-3}$	$\sqrt{2x-3}$	$2x-3$

$1 + 2\sqrt{2x-3} + 2x-3$

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Multiple Choice.

19. Simplify: $\frac{3m}{2m+1} + \frac{11m+7}{2m+1} = \frac{14m+7}{2m+1} = \frac{7(2m+1)}{2m+1}$

A. 2 B. $\frac{7m+7}{2}$ C. $\frac{14m+7}{2m}$ D. 7

20. Simplify: $\frac{y(9)}{y(y-2)} - \frac{2(y-2)}{y(y-2)} = \frac{9y-2y+4}{y(y-2)}$

A. $\frac{-7y+4}{y^2-2y}$ B. $\frac{-7y-4}{y^2-2y}$ C. $\frac{7y+4}{y^2-2y}$ D. $\frac{7y+2}{y^2-2y}$

1. If varies inversely as x. If y [illegible] = -3, find y when [illegible]

21. Subtract and simplify: $\frac{(x+6)2x+8}{x^2+6x+8} - \frac{(x+16)(x+4)}{x^2+8x+12} = \frac{(2x^2+8x+12x+48)-(x^2+20x+64)}{(x+2)(x+4)(x+6)}$

$(x+2)(x+4)$ $(x+6)(x+2)$

64
48
16

$= \frac{x^2 - 16}{(x+2)(x+4)(x+6)}$ $(x+4)(x-4)$

A. $\frac{x-8}{-2x-4}$ B. $\frac{x-4}{(x+2)(x+6)}$ C. $\frac{x-8}{(x+4)(x+6)}$ D. $\frac{-x-14}{(x+2)(x+6)}$

2. The voltage of an electrical circuit varies directly as the current. If there are 100 [illegible] the current is [illegible] and [illegible] when the current is 1[illegible] amperes.

22. Simplify: $\frac{3x^2-6x}{4-x^2} \cdot \frac{3x^2+5x-2}{27x^2-3}$ $\frac{3x(x-2)}{-1(x+2)(x-2)} \cdot \frac{(3x-1)(x+2)}{3(9x^2-1)}$ $\frac{(3x+1)(3x-1)}{3(3x+1)(3x-1)}$ $= \frac{x}{-1(3x+1)}$ or $\frac{-x}{3x+1}$

A. $\frac{-x}{3x+1}$ B. $\frac{-x(x-2)}{(3x-1)(x+2)}$ C. $\frac{x(x-2)}{(3x-1)(x+2)}$ D. $\frac{-x(x+2)}{(3x-1)(x+2)}$

23. Simplify:

Inverse Variation: y varies inversely as x^n

$\frac{2x(2x-y)^{-2}}{4x^{-2}} \div \frac{(2x-y)^{-1}}{8x} = \frac{2x \cdot x^2}{4(2x-y)^2} \div \frac{1}{8x(2x-y)} = \frac{2x^3}{4(2x-y)^2} \cdot \frac{8x(2x-y)}{1}$ $2x-y$ 2

$\frac{4x^4}{2x-y}$

A. $\frac{1}{2(2x-y)}$ B. $\frac{x^4}{2(2x-y)^3}$ C. $\frac{x^2}{2(2x-y)}$ D. $\frac{4(x^4)}{2x-y}$

3. Varies [illegible] x. If [illegible] = -3, [illegible] = -11.

24. Simplify: $\frac{4a-28}{6} \div \frac{a^2-49}{3a-21}$ $\frac{4(a-7)}{6} \cdot \frac{3(a-7)}{(a+7)(a-7)} = \frac{2(a-7)}{(a+7)}$ 2

A. $\frac{2(a-7)}{(a+7)}$ B. $\frac{2a-14}{7}$ C. $\frac{a^2+4a-77}{6(3a-21)}$ D. $\frac{a-8}{6(a-7)}$

4. The height of a triangle varies inversely as the length of the base. If the height is [illegible] the base is 8 cm, what is the height when the base is 9 cm?

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2. Motion and Stability

Force and Stability