① $\frac{x^2-y^2}{x+y}$

$\frac{(x+y)(x-y)}{x+y}$

$\boxed{x-y}$

② $\frac{2x^3-18x}{x+3}$

$\frac{2x(x^2-9)}{x+3}$

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

$\boxed{2x(x-3)}$

③ $\frac{x^2-2x-15}{x^2-4} \cdot \frac{x^2-x-2}{x^2-9}$

$\frac{(x-5)(x+3)}{(x+2)(x-2)} \cdot \frac{(x-2)(x+1)}{(x+3)(x-3)}$

$\boxed{\frac{(x-5)(x+1)}{(x+2)(x-3)}}$

④ $\frac{a^3+4a}{a^2-16} \div \frac{a^2+8a+15}{a^2+a-20}$

$\frac{a^3+4a}{a^2-16} \cdot \frac{a^2+a-20}{a^2+8a+15}$

$\frac{a(a^2+4)}{(a+4)(a-4)} \cdot \frac{(a+5)(a-4)}{(a+5)(a+3)}$

$\boxed{\frac{a(a^2+4)}{(a+4)(a+3)}}$

⑤ $\frac{x}{x-y} - \frac{2x}{x^2-y^2}$

$\frac{(x+y) \cdot x}{(x+y) \cdot x-y} - \frac{2x}{(x+y)(x-y)}$

$\frac{x^2+xy}{(x+y)(x-y)} - \frac{2x}{(x+y)(x-y)}$

$\frac{x^2+xy-2x}{(x+y)(x-y)}$

$\boxed{\frac{x(x+y-2)}{(x+y)(x-y)}}$

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(6) $\frac{3a}{4a-20} + \frac{9a}{6a-30}$

$3 \cdot \frac{3a}{3 \cdot 4(a-5)} + \frac{9a}{6(a-5)} \cdot 2$

$\frac{9a}{12(a-5)} + \frac{18a}{12(a-5)}$

$\frac{27a}{12(a-5)}$ (9, 4)

$\boxed{\frac{9a}{4(a-5)}}$

(7) $\frac{2x+1}{x^2+2x-15} - \frac{x}{x^2+x-20}$

$\frac{(x-4) \cdot 2x+1}{(x-4) \cdot (x+5)(x-3)} - \frac{x \cdot (x-3)}{(x+5)(x-4) \cdot (x-3)}$

$\frac{2x^2+x-8x-4}{(x-4)(x+5)(x-3)} + \frac{-x^2+3x}{(x-4)(x+5)(x-3)}$

$\boxed{\frac{x^2-4x-4}{(x-4)(x+5)(x-3)}}$

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

$\frac{(c+4) \cdot c}{(c+4) \cdot c+1} - \frac{4 \cdot (c+1)}{c+4 \cdot (c+1)} + \frac{3}{(c+4)(c+1)}$

$\frac{c^2+4c}{(c+4)(c+1)} + \frac{-4c-4}{(c+4)(c+1)} + \frac{3}{(c+4)(c+1)}$

$\frac{c^2-1}{(c+4)(c+1)}$

$\frac{(c+1)(c-1)}{(c+4)(c+1)} = \boxed{\frac{c-1}{c+4}}$

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(9) $\dfrac{\dfrac{x^2-16}{x-3}}{\dfrac{2x^2+5x-12}{x^2-9}}$

KCF

-24, 8, -3, 5

$(2x^2+8x)-(3x-12)$

$2x(x+4)-3(x+4)$

$(x+4)(2x-3)$

$\dfrac{x^2-16}{x-3} \cdot \dfrac{x^2-9}{2x^2+5x-12}$

$\dfrac{(x+4)(x-4)}{x-3} \cdot \dfrac{(x+3)(x-3)}{(x+4)(2x-3)}$

$$\boxed{\dfrac{(x-4)(x+3)}{2x-3}}$$

(10) $\dfrac{2}{x-3} = \dfrac{5}{x+6}$

$2(x+6) = 5(x-3)$

$2x+12 = 5x-15$

$-2x \quad -2x$

$12 = 3x-15$

$+15 \quad +15$

$\dfrac{27}{3} = \dfrac{3x}{3}$

$$\boxed{9 = x}$$

(11) $\dfrac{1}{x} = \dfrac{x-3}{40}$

$40 = x(x-3)$

$40 = x^2-3x$

$-40 \quad -40$

$0 = x^2-3x-40$

$0 = (x-8)(x+5)$

$$\boxed{x = 8, -5}$$

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(12) $\left(\frac{n^2-n-6}{n^2}\right)+\left(\frac{-2n+12}{n}\right)=\left(\frac{n-6}{2n}\right)^{n}$

$2n^2-2n-12-4n^2-24n=n^2-6n$

$-2n^2-26n-12=n^2-6n$
$+2n^2+26n+12 \quad +2n^2+26n+12$

$0=3n^2+20n+12$

$0=(3n^2+18n)+(2n+12)$

$0=3n(n+6)+2(n+6)$

$0=(n+6)(3n+2)$

$n=-6, -\frac{2}{3}$

36 → 18, 2 → 20

(13) $\left(\frac{1}{2}\right)+\left(\frac{12}{x}\right)=\left(\frac{x}{4}\right)^{4x}$

$2x+48=x^2$
$-2x-48 \quad -2x-48$

$0=x^2-2x-48$

$0=(x-8)(x+6)$

$x=8, -6$

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(14) $\frac{3}{x-8} - \frac{4}{x-2} = \frac{28}{x^2-10x+16}$

$(x-8)(x-2)\frac{3}{x-8} - \frac{4}{x-2}^{(x-8)(x-2)} = \frac{28}{(x-8)(x-2)}(x-8)(x-2)$

$3x-6-4x+32=28$

$-x+26=28$

$-26 \quad -26$

$-x=2$

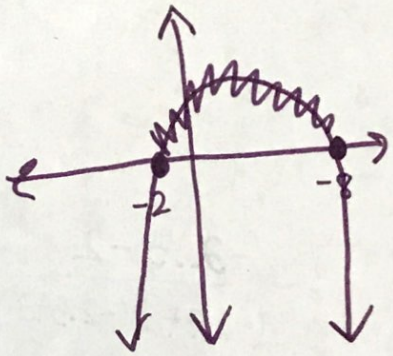
$\boxed{x=-2}$

(15) $-16x^2+96x+256>0$

$-16(x^2-6x-16)>0$

$-16(x-8)(x+2)>0$

$x=8,-2$



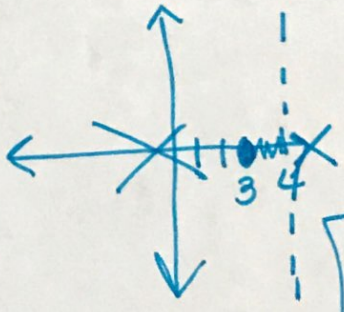
$\boxed{(-2,-8)}$

(16) $\frac{2x-7}{x-4} - \frac{1}{1}^{\cdot(x-4)} \leq 0$

$\frac{2x-7}{x-4} + \frac{-x+4}{x-4} \leq 0$

$\frac{x-3}{x-4} \leq 0$

CP: 3 Asy: $x=4$



$\boxed{[3,4)}$

Test:

$\frac{0-3}{0-4} \leq 0$ $\quad \frac{3}{4} \leq 0$ $\quad X$

$\frac{3.5-3}{3.5-4} \leq 0$ $\quad \frac{0.5}{-0.5} \leq 0$ $\quad -1 \leq 0$

$\frac{5-3}{5-4} \leq 0$ $\quad \frac{2}{1} \leq 0$ $\quad 2 \leq 0$ $\quad \times$

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(17) $\frac{5}{x+3} \geq \frac{4}{x+2}$

$-\frac{4}{x+2} \quad -\frac{4}{x+2}$

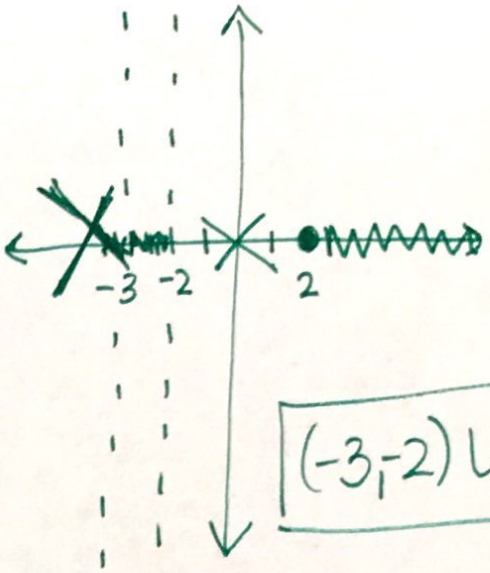
$\frac{(x+2)5}{(x+2)(x+3)} - \frac{4(x+3)}{(x+2)(x+3)} \geq 0$

$\frac{5x+10}{(x+2)(x+3)} + \frac{-4x-12}{(x+2)(x+3)} \geq 0$

$\frac{x-2}{(x+2)(x+3)} \geq 0$

CP: 2

Asy: $x=-2$, $x=-3$



$(-3,-2) \cup [2,\infty)$

Test:

$\frac{-4-2}{(-4+2)(-4+3)} \geq 0$

$-3 \geq 0$

$\frac{-2.5-2}{(-2.5+2)(-2.5+3)} \geq 0$

$18 \geq 0$

$\frac{0-2}{(0+2)(0+3)} \geq 0$

$-\frac{1}{3} \geq 0$

$\frac{3-2}{(3+2)(3+3)} \geq 0$

$\frac{1}{30} \geq 0$

(18) $\left(\frac{1}{10}\right) + \left(\frac{1}{x}\right) = \left(\frac{1}{3.5}\right)$ (multiply by $21x$: 3.5, $21x$, 6)

$3.5x + 21 = 6x$

$-3.5x \quad -3.5x$

$21 = 2.5x$

$8.4 = x$

8.4 hrs

(19) $\left(\frac{1}{20}\right) + \left(\frac{1}{24}\right) = \left(\frac{1}{x}\right)$ (multiply by $480x$: 24, 20)

$24x + 20x = 480$

$44x = 480$

$x = 10.9$ mins

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(20) $6x\left(\frac{1}{x}\right)+3\cancel{6}x\left(\frac{1}{2x}\right)=\left(\frac{1}{6}\right)6x$

$6+3=x$

$9=x$

Sarah $= 9(2)$

$=$ **18 hrs**

(21) $\frac{x-3}{x+25}=\frac{1}{3}$

$3(x-3)=x+25$

$3x-9=x+25$

$-x \quad -x$

$2x-9=25$

$+9 \quad +9$

$2x=34$

$x=17$

(22)

	D	R	T
Car	300	$x+20$	$\frac{300}{x+20}$
Train	200	x	$\frac{200}{x}$

$\frac{300}{x+20}=\frac{200}{x}$

$300x=200(x+20)$

$300x=200x+4000$

$-200x \quad -200x$

$100x=4000$

$x=40$

Car $= 40+20$

$= 60$

Car 60 km/hr

Train 40 km/hr

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