① 

$$f(x) = g(x)$$

$$x^3 + 5x^2 = 4x + 20$$

$$x^3 + 5x^2 - 4x - 20 = 0$$

$$x^2(x+5) - 4(x+5) = 0$$

$$(x+5)(x^2-4) = 0$$

$$(x+5)(x-2)(x+2) = 0$$

| $x+5=0$ | $x-2=0$ | $x+2=0$ |
|---|---|---|
| $x=-5$ | $x=2$ | $x=-2$ |

$$\{-5, -2, 2\}$$

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② 

$$4z^4 - 17z^2 + 4 = 0$$

$$(4z^2 - 1)(z^2 - 4) = 0$$

$$(2z-1)(2z+1)(z-2)(z+2) = 0$$

| $2z-1=0$ | $2z+1=0$ | $z-2=0$ | $z+2=0$ |
|---|---|---|---|
| $z = \frac{1}{2}$ | $z = -\frac{1}{2}$ | $z = 2$ | $z = -2$ |

$$\left\{-2, -\frac{1}{2}, \frac{1}{2}, 2\right\}$$

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③ $\langle f(t) = 0 \leftarrow$ hit the ground $\rangle$

$$f(t) = -16t^2 + 576$$

$$0 = -16t^2 + 576$$

$$0 = -16(t^2 - 36)$$

$$0 = -16(t-6)(t+6)$$

| $t-6=0$ | $t+6=0$ |
|---|---|
| $t=6$ | $t \neq -6$ |

It will hit the ground after 6 seconds.

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④



original / New / $2x$ / $2x+3$ / $x$ / $x+7$
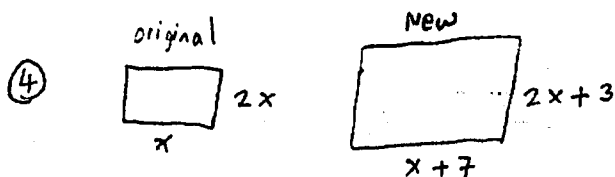
① let 
width of original ▭ $= 2x$
length of original ▭ $= x$
width of new ▭ $= 2x+3$
length of new ▭ $= x+7$

② 
$$(2x+3)(x+7) = 40$$
$$2x^2 + 17x + 21 = 40$$
$$2x^2 + 17x - 19 = 0$$
$$(2x+19)(x-1) = 0$$

| $2x+19=0$ | $x-1=0$ |
|---|---|
| $x \neq -\frac{19}{2}$ | $x = 1$ |

③ The width of original ▭ is 2 in and length is 1 in.

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⑤ 
$$\frac{x^3 - 27}{2x^2 + 5x - 25} \div \frac{x^3 + 3x^2 + 9x}{x^2 + 2x - 15} \cdot \frac{2x^2 - 5x}{x^2 - 6x + 9}$$

$$= \frac{x^3 - 27}{2x^2 + 9x - 25} \cdot \frac{x^2 + 2x - 15}{x^3 + 3x^2 + 9x} \cdot \frac{2x^2 - 5x}{x^2 - 6x + 9}$$

$$= \frac{(x-3)(x^2+3x+9)}{(2x-5)(x+5)} \cdot \frac{(x+5)(x-3)}{x(x^2+3x+9)} \cdot \frac{x(2x-5)}{(x-3)^2}$$

$$= \frac{1}{1}$$

## ⑥

$$\frac{x+4}{x^2-5x+6} + \frac{x-1}{x^2-2x-3} - \frac{2x+1}{x^2-x-2}$$

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

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

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

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

$$= \frac{7x+9}{(x-3)(x-2)(x+1)} \quad /\!/$$

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## ⑦

$$\frac{r^{-2}s^{-1} - r^{-1}s^{-2}}{4r^{-2} - 4s^{-2}}$$

$$= \frac{\left(\dfrac{1}{r^2 s} - \dfrac{1}{r s^2}\right)}{\left(\dfrac{4}{r^2} - \dfrac{4}{s^2}\right)} \cdot \frac{r^2 s^2}{r^2 s^2}$$

$$= \frac{s - r}{4s^2 - 4r^2}$$

$$= \frac{s-r}{4(s-r)(s+r)}$$

$$= \frac{1}{4(s+r)} \quad /\!/.$$

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## ⑧

$$\frac{6}{t^2-1} \cdot \frac{3}{t^2-5t-6} + \frac{3}{t^2-7t+6}$$

$$= \frac{6}{(t-1)(t+1)} \cdot \frac{3}{(t-6)(t+1)} + \frac{3}{(t-6)(t-1)}$$

$$(t-6)(t-1)(t+1) \cdot \left[\frac{6}{(t-1)(t+1)}\right] = \left[\frac{6}{(t-1)(t+1)}\right] \cdot (t-6)(t-1)(t+1)$$

$$3(t-1) + 3(t+1) = 6(t-6)$$

$$3t-3 + 3t+3 = 6t-36$$

$$6t = 6t-36$$

$$0 = -36$$

$$\phi$$

$$t \neq 6, -1, 1$$

⑨

$$\frac{3x + 20}{x + 6} < 5$$

$$\frac{3x + 20}{x + 6} - 5 < 0$$

$$\frac{(3x + 20) - 5(x + 6)}{x + 6} < 0$$
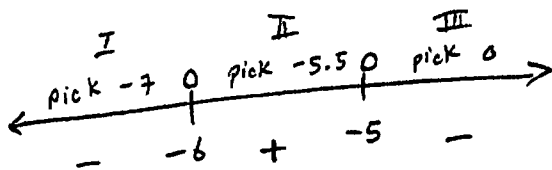
$$\frac{3x + 20 - 5x - 30}{x + 6} < 0$$

$$\frac{-2x - 10}{x + 6} < 0$$

$$\frac{-2(x + 5)}{x + 6} < 0$$

**zero**

$x + 5 = 0$

$x = -5$

**undefined**

$x + 6 \neq 0$

$x \neq -6$

I     II     III

pick -7   pick -5.5   pick 0

$\xleftarrow{\quad\quad} \underset{-6}{|} \; + \; \underset{-5}{|} \; - \xrightarrow{\quad}$

$(-\infty, -6) \cup (-5, \infty)$ //

$\xleftarrow{\quad} \overset{\circ}{\underset{-6}{|}} \quad \overset{\circ}{\underset{-5}{|}} \xrightarrow{\quad}$ //

⑩

| | $r$ | $t$ | $= wc$ |
|---|---|---|---|
| Men Aun | $\frac{1}{60}$ | 60 | 1 |
| ① Venus | $\frac{1}{80}$ | 80 | 1 |
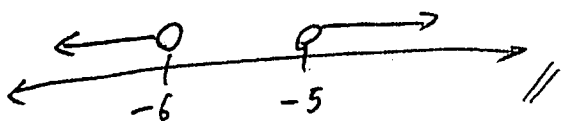
let $t =$ time together.

② $\left(\frac{1}{60} - \frac{1}{80}\right) \cdot t = 1$

$$\frac{t}{60} - \frac{t}{80} = 1$$

$$4t - 3t = 240$$

$$t = 240$$

③ It will take 240 mins or 4 hrs

⑪ a) $a^4 - 16 b^4$

$= (a^2 - 4b^2)(a^2 + 4b^2)$

$= (a - 2b)(a + 2b)(a^2 + 4b^2)$

b) $(c-1)^3 - 216 d^3$

$= \left[(c-1) - 6d\right]\left[(c-1)^2 + (c-1)(6d) + (6d)^2\right]$

$= \left[c - 6d - 1\right]\left[c^2 - 2c + 1 + 6cd - 6d + 36d^2\right]$

c) $24 e^3 f - 66 e^2 f - 63 ef$

$= 3ef(8e^2 - 22e - 21)$

$= 3ef(4e + 3)(2e - 7)$

d) $2g^4h + 14g^3h - 32g^2h - 224gh$

$= 2gh\left[g^3 + 7g^2 - 16g - 112\right]$

$= 2gh\left[g^2(g+7) - 16(g+7)\right]$

$= 2gh\,(g+7)(g^2-16)$

$= 2gh\,(g+7)(g-4)(g+4)$

e) $18(i+1)^2 - 9(i+1) - 20$

   let $u = i+1$

   $= 18u^2 - 9u - 20$

   $= (6u + 5)(3u - 4)$

   $= \left[6(i+1)+5\right]\left[3(i+1)-4\right]$

   $= \left[6i + 11\right]\left[3i - 1\right]$

f) $4j - 12j + 9 - k^2$

   $= (2j - 3)^2 - k^2$

   $= (2j - 3 - k)(2j - 3 + k)$