Show all necessary steps Clearly, Neatly, and Systematically to receive full credit. Any incorrect statement will be penalized.

1. Multiply:

a) $[r - (s + t)]^2$

$= r^2 - 2 \cdot r \cdot (s+t) + (s+t)^2$

$= r^2 - 2rs - 2rt + s^2 + 2st + t^2$ //

b) $[(u - v) - w][(u - v) + w]$

$= (u-v)^2 - w^2$

$= u^2 - 2uv + v^2 - w^2$ //

2. If a rock is dropped from a building of 576 ft high, then its distance in feet from the ground t second later is a function defined by $f(t) = -16t^2 + 576$. How long after it is dropped will it hit the ground?

$f(t) = 0$

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

$0 = -16t^2 + 576$

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

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

$t - 6 = 0 \qquad t + 6 = 0$

$t = 6 \qquad t = -6$

it will hit the ground after 6 sec. /

3. Simplify: $\dfrac{\left(2m^3x^{-2}\right)^{-1}\left(3m^{-4}x\right)^{-3}}{\left(m^2x^3\right)^3\left(m^2x^{-1}\right)^{-5}}$.

$$= \dfrac{\left(m^2x^{-1}\right)^5}{\left(m^2x^3\right)^3\left(2m^3x^{-2}\right)^1\left(3m^{-4}x\right)^3}$$

$$= \dfrac{m^{10}\ x^{-5}}{m^6x^9 \cdot 2\,m^3x^{-2} \cdot 27\,m^{-12}x^3}$$

$$= \dfrac{m^{10}\ x^{-5}}{54\ m^{-3}\ x^{10}}$$

$$= \dfrac{m^{10}\ m^3}{54\ x^{10}\ x^5}$$

$$= \dfrac{m^{13}}{54\ x^{15}} \quad /\!/$$

4. Solve: $2x(11x^2 - 18) = -3x^3 + 28x$.

$$22x^3 - 36x = -3x^3 + 28x$$

$$25x^3 - 64x = 0$$

$$x\left(25x^2 - 64\right) = 0$$

$$x\left(5x - 8\right)\left(5x + 8\right) = 0$$

$$x = 0 \qquad 5x - 8 = 0 \qquad 5x + 8 = 0$$

$$x = \frac{8}{5} \qquad x = -\frac{8}{5}$$

$$\left\{ -\frac{8}{5},\ 0,\ \frac{8}{5} \right\} \quad /\!/$$

5. Perform indicated operation: $\dfrac{5x}{x^2-6x+9} - \dfrac{2}{x^2-4x+3} - \dfrac{1}{1-x}$.

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

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

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

$$= \frac{5x^2 - 5x - 2x + 6 + x^2 - 6x + 9}{(x-3)^2(x-1)}$$

$$= \frac{6x^2 - 13x + 15}{(x-3)^2(x-1)} \quad //$$

6. Simplify: $\dfrac{r^{-2} - 4s^{-2}}{3s^{-1} - 6r^{-1}}$

$$= \frac{\dfrac{1}{r^2} - \dfrac{4}{s^2}}{\dfrac{3}{s} - \dfrac{6}{r}} \cdot \frac{r^2 s^2}{r^2 s^2}$$

$$= \frac{s^2 - 4r^2}{3r^2 s - 6rs^2}$$

$$= \frac{(s-2r)(s+2r)}{3rs(r-2s)} \quad //$$

7. Solve: $3x(3x+2) - 6x = (5x+2)^2$.

$$9x^2 + 6x - 6x = 25x^2 + 20x + 4.$$

$$9x^2 = 25x^2 + 20x + 4$$

$$0 = 16x^2 + 20x + 4$$

$$0 = 4(4x^2 + 5x + 1)$$

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

$$4x+1 = 0 \qquad x+1 = 0$$
$$\qquad\qquad\qquad x = -1$$
$$x = -\tfrac{1}{4}$$

$$\left\{ -1, -\tfrac{1}{4} \right\} \;//$$

8. Perform indicated operation: $\dfrac{2a^3 + 3a^2 - 2a}{3a-15} \div \dfrac{2a^3 - a^2}{a^2 - 3a - 10} \div \dfrac{3a^2 + 12a + 12}{10a - 5a^2}$.

$$= \frac{2a^3 + 3a^2 - 2a}{3a - 15} \cdot \frac{a^2 - 3a - 10}{2a^3 - a^2} \cdot \frac{10a - 5a^2}{3a^2 + 12a + 12}$$

$$= \frac{a(2a-1)(a+2)}{3(a-5)} \cdot \frac{(a-5)(a+2)}{a^2(2a-1)} \cdot \frac{5a(2-a)}{3(a+2)^2}$$

$$= \frac{5(2-a)}{9} \;//$$

9. The width of a rectangle is twice its length. If its width is increased by 3 in., and its length is increased by 7 in., then the area of the new rectangle is 40 in.^{2}. Find the dimensions of the original rectangle. (*make sure to show in 3-steps format*)

original   New

② $(2x+3)(x+7) = 40$

$2x^2 + 17x + 21 = 40$

$2x^2 + 17x - 19 = 0$

$(2x+19)(x-1) = 0$
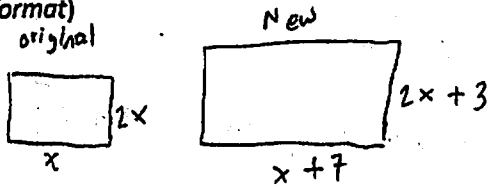
$2x + 19 = 0 \qquad x - 1 = 0$

$x = -\dfrac{19}{2} \qquad x = 1$

① width of original ▭ $= 2x$

   length of original ▭ $= x$

   width of new ▭ $= 2x + 3$

   length of new ▭ $= x + 7$

③ width of original ▭ $= 2$ in.

   length of original ▭ $= 1$ in

10. Solve: $\dfrac{2}{t-5} = \dfrac{22}{2t^2 - 9t - 5} - \dfrac{3}{2t+1}$.

$\dfrac{2}{t-5} = \dfrac{22}{(2t+1)(t-5)} - \dfrac{3}{2t+1} \qquad t \neq 5, -\dfrac{1}{2}$

$(2t+1)(t-5)\left(\dfrac{2}{t-5}\right) = \left(\dfrac{22}{(2t+1)(t-5)} - \dfrac{3}{2t+1}\right)(2t+1)(t-5)$

$2(2t+1) = 22 - 3(t-5)$

$4t + 2 = 22 - 3t + 15$

$4t + 2 = -3t + 37$

$7t + 2 = 37$

$7t = 35$

$t = 5$

ϕ

11. Factor Completely.

a. $18p^3q + 53p^2q^2 - 35pq^3$

$= pq(18p^2 + 53pq - 35q^2)$

$= pq(9p - 5)(2p + 7q)$

b. $56m^3 - 448$

$= 56(m^3 - 8)$

$= 56(m - 2)(m^2 + 2m + 4)$

c. $16 - n^4$

$= (4 - n^2)(4 + n^2)$

$= (2 - n)(2 + n)(4 + n^2)$

d. $w^2 - 10w + 25 - c^2$

$= (w - 5)^2 - c^2$

$= [(w - 5) - c][(w - 5) + c]$

e. $2(u + v)^2 - 7(u + v) - 4$

Let $x = u + v$

$= 2x^2 - 7x - 4$

$= (2x + 1)(x - 4)$

$= [2(u + v) + 1][(u + v) - 4]$

$= [2u + 2v + 1][u + v - 4]$

f. $32h^2 + 16h^3 - 24h^5$

$= 8h^2(4 + 2h - 3h^3)$