1. The expression $x^2(x+2)-(x+2)$ is equivalent to

1) x^2
2) x^2-1
3) x^3+2x^2-x+2
4) $(x+1)(x-1)(x+2)$

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

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

$xa+ya$

$=a(x+y)$

2. When factored completely, $x^3+3x^2-4x-12$ equals

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

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

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

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

3. Factor: $a^2 - 3ab - a + 3b$

$= a(a-3b) - 1(a-3b)$

$= (a-3b)(a-1)$

$-3a - a$

4. Factored completely, the expression $12x^4 + 10x^3 - 12x^2$ is equivalent to

1) $x^2(4x+6)(3x-2)$
2) $2(2x^2+3x)(3x^2-2x)$
3) $2x^2(2x-3)(3x+2)$
4) $2x^2(2x+3)(3x-2)$

-36

$9 \quad -4$

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

$= 2x^2(6x^2 + 9x - 4x - 6)$

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

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

5. Factor: $3a^2 + a - 2$ $\quad -6$

$3 \quad -2$

$= 3a^2 + 3a - 2a - 2$

$= 3a(a+1) - 2(a+1)$

$= (a+1)(3a-2)$

6. Factor: $10x^2 + 11x - 6 \rightarrow -60$

$15 \quad -4$

$= 10x^2 + 15x - 4x - 6$

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

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

7. Factor: $12a^2 + 14a - 6$

$= 2(6a^2 + 7a - 3)$ $\quad -18$ $\quad 9, -2$

$= 2(6a^2 + 9a - 2a - 3)$

$= 2(3a(2a+3) - 1(2a+3))$

$= 2(2a+3)(3a-1)$

8. Factor: $16x^2 - 9$

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

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

9. Factor: $a^4 - 16$

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

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

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

10. Express in simplest form: $\frac{36 - x^2}{x^2 + 8x + 12} \div \frac{x^2 - 6x}{x - 2}$

$$= \frac{\overset{-1}{\cancel{(6-x)}}\cancel{(6+x)}}{\cancel{(x+6)}(x+2)} \cdot \frac{x-2}{x\cancel{(x-6)}} = \frac{-x+2}{x(x+2)}$$

11. Perform the indicated operation and express in *simplest form*:

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

$\boxed{2x^2+x-6}$ -12 $-3, 4$

$2x^2-3x+4x-6$

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

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

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

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

12. Perform the indicated operations and express in lowest terms:

$$\frac{x^2-9}{2x+4} \cdot \boxed{\frac{x^2+7x+10}{x^2-3x-18}} \div \frac{x^2+2x-15}{2x^2-12x}$$

$$= \frac{\cancel{(x-3)}\cancel{(x+3)}}{\cancel{2}\cancel{(x+2)}} \cdot \frac{\cancel{(x+5)}\cancel{(x+2)}}{\cancel{(x-6)}\cancel{(x+3)}} \cdot \frac{\cancel{2}x\cancel{(x-6)}}{\cancel{(x+5)}\cancel{(x-3)}}$$

$$= x$$

13. Express in simplest form: $\dfrac{x^2-16}{2x^2+4x}\cdot\dfrac{x^2+9x+14}{x^2+2x-8}\div\dfrac{x^2+3x-28}{16x-8x^2}$

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

$$=-4$$

14. Perform the indicated operations and simplify: $\dfrac{x^2+4xy+3y^2}{x^2-y^2}\cdot\dfrac{x^2+xy}{x-y}\div\dfrac{x^2+3xy}{(x-y)^2}$

$$=\frac{\cancel{(x+3y)}\cancel{(x+y)}}{\cancel{(x+y)}\cancel{(x-y)}}\cdot\frac{\cancel{x}(x+y)}{\cancel{x-y}}\cdot\frac{\cancel{(x-y)}\cancel{(x-y)}}{\cancel{x}\cancel{(x+3y)}}$$

$$=x+y$$

15. Expressed as a single fraction, $\frac{3}{x-1} - \frac{2}{x}$ is equivalent to

1) $\frac{1}{x(x-1)}$

2) $\frac{x-2}{x(x-1)}$

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

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

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

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

16. Expressed as a single fraction, $\frac{5}{x-3} - \frac{1}{x}$ is equivalent to

1) $\frac{6x-3}{x^2-3x}$

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

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

4) $\frac{4}{x^2-3x}$

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

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

17. The expression $\frac{6}{y-5} - \frac{y+5}{y^2-25}$ is equivalent to

1) $\frac{5}{y-5}$

2) $\frac{5}{y+5}$

3) $\frac{5y}{y-5}$

4) $\frac{5y}{y+5}$

$$\frac{6}{y-5} - \frac{\cancel{y+5}}{(y-5)\cancel{(y+5)}} = \frac{6}{y-5} - \frac{1}{y-5}$$

$$= \frac{5}{y-5}$$

18. The expression $\frac{x}{x-1} + \frac{x}{x+1}$ is equivalent to

1) 1

2) $\frac{2x}{x^2-1}$

3) ~~2~~

4) $\frac{2x^2}{x^2-1}$

$$\frac{(x+1)x}{(x+1)(x-1)} + \frac{x\ (x-1)}{(x+1)(x-1)}$$

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

19. Express in simplest form: $\frac{3x}{2x-6}+\frac{9(-1)}{(6-2x)(-1)}$

$$\frac{3x}{2x-6}+\frac{-9}{2x-6}$$

$$=\frac{3x-9}{2x-6}=\frac{3\cancel{(x-3)}}{2\cancel{(x-3)}}=\frac{3}{2}$$

20. Express in simplest form: $\frac{3a+1}{a^2-1}-\frac{1}{a+1}$

$$=\frac{3a+1}{(a+1)(a-1)}-\frac{1(a-1)}{(a+1)(a-1)}$$

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

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

21. Simplify: $\left(\dfrac{a+2b}{2a+b}-\dfrac{a-2b}{2a-b}\right)\left(\dfrac{1}{b}+\dfrac{b}{2ab}\right)$

$$=\left(\frac{(a+2b)(2a-b)}{(2a+b)(2a-b)}-\frac{(a-2b)(2a+b)}{(2a-b)(2a+b)}\right)\left(\frac{1\cdot 2a}{b\cdot 2a}+\frac{b}{2ab}\right)$$

$$=\frac{(\cancel{2a^2}+3ab-\cancel{2b^2})-(\cancel{2a^2}-3ab-\cancel{2b^2})}{(2a+b)(2a-b)}\cdot\frac{2a+b}{2ab}$$

$$=\frac{\overset{3}{\cancel{6ab}}}{\cancel{(2a+b)}(2a-b)}\cdot\frac{\cancel{2a+b}}{2\cancel{ab}}=\frac{3}{2a-b}$$

22. Reduce to simplest form: $\left(\dfrac{x}{x-y}-\dfrac{y}{x+y}\right)\div\dfrac{x^2+y^2}{x^2+xy}$

$$\frac{(x+y)\,x}{(x+y)(x-y)}-\frac{y\,(x-y)}{(x+y)(x-y)}=\frac{x^2+\cancel{xy}-\cancel{yx}+y^2}{(x+y)(x-y)}$$

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