

**2023 MTAP Saturday Program in Mathematics Grade 8 Session 1**

Name of Participant: \_\_\_\_\_

A. Factor each expression completely.

1.  $21a^4b^2 + 14a^5b^3 - 35a^3b^4$

2.  $5(c - d) + c(c - d)$

3.  $r^6 - 81$

4.  $49 - (m + 2)^2$

5.  $w^2(x + y) - (x + y)^3$

6.  $9m^2 + 24mn + 16n^2$

7.  $81 - 144y^2 + 16y^4$

8.  $a^4 - 28a^2b + 196b^2$

9.  $4h^2 + 29h - 63$

10.  $m^2 - 20m + 99$

11.  $p^3 + 216$

12.  $4 - b^8c^{10}$

13.  $5m^2 + 80m + 320$

14.  $5^{2m} + 5^{m+1} - 6$

15.  $3^{2x+1} + 3^{x+2} - 30$

$7a^2b (3a^2b + 2a^3b^2 - 5ab^3)$

$(c - d)(5 + c)$

$(r^3 + 9)(r^3 - 9)$

$(9 + m)(5 - m)$

$(x + y)(w + x + y)(w - x - y)$

$(3m + 4n)^2$

$(3 - 2y)^2(3 + 2y)^2$

$(a^2 - 14b)^2$

$(4h - 7)(h + 9)$

$(m - 9)(m - 11)$

$(p + 6)(p^2 - 6p + 36)$

$(2 - b^4c^5)(2 + b^4c^5)$

$5(m + 8)^2$

$(5^m + 6)(5^m - 1)$

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

B. Use regrouping, or addition -and-subtraction of suitable terms technique to factor each expression completely.

1.  $r^3 + 2r^2 + 4r + 8$

2.  $m^4 - 2m^2 + 1$

3.  $2xy^2 - 3xy - 2x + 6y^2 - 9y - 6$

4.  $a^2 - b^2 - 7a + 9b - 8$

5.  $p^4 + 10p^2 - 9u^2 + 25$

6.  $y^4 + 8y^2 - z^2 + 16$

7.  $64b^3 - 1$

8.  $m^6n^9 + 8$

$(p^2 + 3u + 5)(p^2 - 3u + 5)$

$(y^2 + z + 4)(x^2 - x + 1)$

$(4b - 1)(16b^2 + 4b + 1)$

$(m^2n^3 + 2)(m^4n^6 - 2m^2n^3 + 4)$

$(r + 2)(r^2 + 4)$

$(m + 1)^2(m - 1)^2$  or  $(m + 1)(m + 1)(m - 1)(m - 1)$

$(x + 3)(2y + 1)(y - 2)$

$(a + b - 8)(a - b + 1)$

C. Simplify each expression.

1. 
$$\frac{6x^2+9}{4x^2+6}$$

2. 
$$\frac{x+5}{x^2+10x+25}$$

3. 
$$\frac{3a^2+a-10}{3a-5}$$

4. 
$$\frac{10x^2+11x+3}{5x^2-32x-21}$$

5. 
$$\frac{49-100y^2}{21x-30xy}$$

6. 
$$\frac{x^3+y^3}{x^2-xy+y^2}$$

7. 
$$\frac{v^3+343}{v^2-49}$$

8. 
$$\frac{(k-r)(h^3-1)}{(k-r)^2(h-1)}$$

9. 
$$\frac{c^2dy+cd^2y+c^2d+cd^2}{cy^2+cy^2+2cy+2dy+c+d}$$

10. 
$$\frac{r^{12}-27s^{12}}{r^8+3r^4s^4+9s^8}$$

11. 
$$\frac{2^{2k+2}+2^{k+2}+1}{2^{2k+1}+3 \cdot 2^k+1}$$

12. 
$$\frac{3^{3k+1}-3^{2k+1}-2 \cdot 3^{2k}-2 \cdot 3^k}{3^{2k+1}-5 \cdot 3^k-2}$$

$$\frac{7+10y}{3x}$$

$$x + y$$

$$\frac{v^2-7v+49}{v-7}$$

$$\frac{h^2+h+1}{k-r}$$

$$\frac{3}{2}$$

$$\frac{1}{x+5}$$

$$a + 2$$

$$\frac{2x+1}{x-7}$$

$$\frac{cd}{y+1}$$

$$\frac{1}{r^4-3s^4}$$

$$\frac{2^{k+1}+1}{2^k+1}$$

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**D. Perform the indicated operation/s. Write the answers in the simplest form.**

1. 
$$\frac{32}{48h} \cdot \frac{4h^2}{16}$$

2. 
$$\frac{2a-6}{4b^2} \cdot \frac{b^3}{6a-18}$$

3. 
$$\frac{y^2+5y-24}{y^2-2y-3} \div \frac{3y+24}{y^2-8y-9}$$

4. 
$$\frac{m^2+8m+12}{m^2-36} \div \frac{m^2+4m+4}{m-6}$$

5. 
$$\frac{a^3-1000}{a^2+10a+100} \cdot \frac{2b^2-4}{a-10} \div \frac{b^2-2}{4}$$

6. 
$$\frac{x^4-y^2}{x^4+2x^2y+y^2} \cdot \frac{x^6+y^3}{3x^2-3y}$$

7. 
$$\frac{3n^2}{n+2} - \frac{7n+2}{n+2}$$

8. 
$$\frac{d^2}{d^3+1} - \frac{d}{d^3+1} + \frac{1}{d^3+1}$$

9. 
$$\frac{1}{x^2-9} - \frac{2}{x+3} + \frac{3}{x-3}$$

10. 
$$\frac{b}{b-c} - \frac{b^2+c^2}{b^2-c^2} + \frac{c}{b+c}$$

11. 
$$\frac{x}{x-y} + \frac{y}{x+y} - \frac{x^2-y^2}{x^2-y^2}$$

12. 
$$\frac{x^2-9}{x^2+6x+9} - \frac{-x^2-5x-6}{x^2+6x+9}$$

$$\begin{aligned} h \\ 6 \\ b \\ 12 \\ \frac{y-9}{3} \\ \frac{1}{m+2} \end{aligned}$$

$$\begin{aligned} 8 \\ \frac{x^4-x^2y+y^2}{3} \\ 3n+1 \\ \frac{1}{d+1} \end{aligned}$$

$$\begin{aligned} \frac{x+16}{(x+3)(x-3)} \\ \frac{b^2+c^2}{b^2-c^2} \\ \frac{2xy}{(x+y)(x-y)} \\ \frac{2x-1}{x+3} \end{aligned}$$

## Part II. Solve each problem accordingly.

- What must be added to  $25 + 20x$  to make it a perfect square trinomial?
- Express the product  $7(13)$  as difference of two squares.
- Rewrite  $17^2 - (17)(11) + 11^2$  as sum of two cubes.
- If  $7a + 7b = 15$  and  $3a - 3b = 4$ , find  $a^2 - b^2$ .
- The difference of two numbers is 16 and the difference of their squares is 384. Find the smaller number.
- Find the algebraic expressions that can represent the dimensions of a rectangle if its area is expressed as  $(2mx + 2my - x - y)$  square units.
- What is the side length of a square whose area is  $(25x^2 + 16y^2 + 9 + 20xy - 15x - 12y)$  square units?
- What is the perimeter of a square if its area is  $16x^2 + 40x + 25$ , where  $x > 0$ ?
- The length of a rectangle is  $(k^2 + 4k + 3)$  cm and its area is  $(k^2 + 2k + 1)(3k^2 + 7k - 6)$  sq.cm. Find the perimeter of the rectangle.

10. Simplify each complex fraction: a. 
$$\frac{\frac{x+5}{x+7}}{\frac{x^2-25}{3x+21}}$$
 b. 
$$2 + \frac{1}{2 + \frac{1}{2 + \frac{1}{2}}}$$

( $2m - 1$ )( $x + y$ )  
 $(5x + 4y - 3)$  square  
 units  
 $(16x + 20)$  units  
 $(8k^2 + 12k + 2)$  cm  
 1. a.  $\frac{3}{x-5}$       b.  $\frac{29}{12}$

4  
 $13^2 - 7^2$   
 $17^3 - 11^3$   
 $\frac{20}{7}$   
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