

Name: KEY

Score: _____ / 100

Student ID: _____

DO NOT OPEN THE EXAM UNTIL YOU ARE TOLD TO DO SO

	1	2	3	4	5	6	7	8	9	10	11	12	Total
✓													
Score													

INSTRUCTIONS FOR STUDENTS

- Questions are on both sides of the paper. This is an 11 question exam (One extra credit problem can be attempted for a total of 12 questions).
- Students have 2 hours and 15 minutes to complete the exam.
- **PLEASE SHOW ALL WORK.** Any unjustified claims will receive no credit. Clearly box your final answer.
- You **MUST** complete 11 problems for credit. In the above table in the row with the ✓, please mark with a ✓ which problems you want to be graded. If you wish to do a 12th problem for extra credit, please write *EC* in the ✓ row for the problem you wish to be counted for extra credit.
- No notes, textbooks, phones, calculators, etc. are allowed for the exam.
- Each of the 11 questions you choose to do will be graded out of 3 points. The score will then be totaled and multiplied by 3 to get a raw score out of 99 points. One point will be given for clearly writing your name on the exam sheet. This will get you to 100 points. If you choose to do a 12th problem for extra credit, the most that will be awarded for that question will be 3 points. So, the highest possible score on this examination is 103 points out of 100.
- The back of the test can be used for scratch work.

GOOD LUCK!

1) Simplify the following expression completely

$$\frac{x^2 - 6x - 16}{x^2 + 6x + 8}$$

$$= \frac{(x-8)(x+2)}{(x+4)(x+2)} = \boxed{\frac{x-8}{x+4}}$$

2) Perform the indicated operation and simplify completely:

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

$$= \frac{6x(x-1)}{(x-2)(x+1)} \cdot \frac{x(x-1)}{(3x+1)(x-2)}$$

$$= \frac{6x \cancel{(x-1)}}{\cancel{(x-2)}(x+1)} \cdot \frac{(3x+1)\cancel{(x-2)}}{\cancel{x(x-1)}}$$

$$= \boxed{\frac{6(3x+1)}{x+1}}$$

3) Perform the operations and simplify completely:

$$\frac{6x^3 - x}{6x - 6} - \frac{6 - x}{6x - 6}$$

Same denominator

$$\begin{aligned} &= \frac{6x^3 - \cancel{x} - 6 + \cancel{x}}{6x - 6} = \frac{6x^3 - 6}{6x - 6} \\ &= \frac{\cancel{6}(x^3 - 1)}{\cancel{6}(x - 1)} \\ &= \frac{(x - 1)(x^2 + x + 1)}{\cancel{(x - 1)}} \\ &= \boxed{x^2 + x + 1} \end{aligned}$$

4) Perform the operations and simplify completely:

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

$$\text{LCD} = x + 2$$

$$\Rightarrow \frac{4x}{x+2} + \frac{x}{1} \frac{(x+2)}{(x+2)}$$

$$\Rightarrow \frac{4x + x^2 + 2x}{x+2} = \frac{x^2 + 6x}{x+2} = \boxed{\frac{x(x+6)}{x+2}}$$

5) Perform the operations and simplify:

$$\frac{x}{x^2 - 2x - 15} - \frac{x+1}{x^2 - x - 12}$$

$$\frac{x}{(x-5)(x+3)} - \frac{x+1}{(x-4)(x+3)} \quad \text{LCD: } (x-5)(x+3)(x-4)$$

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

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

6) Simplify the complex fraction completely:

$$\frac{\frac{1}{m} - \frac{1}{n}}{\frac{m}{n} - \frac{n}{m}}$$

LCD is mn for
top and bottom

$$= \frac{\frac{n}{n} \cdot \frac{1}{m} - \frac{1}{n} \cdot \frac{m}{m}}{\frac{m}{m} \cdot \frac{m}{n} - \frac{n}{m} \cdot \frac{n}{n}} = \frac{\frac{n}{nm} - \frac{m}{nm}}{\frac{m^2}{mn} - \frac{n^2}{mn}} = \frac{\frac{n-m}{mn}}{\frac{m^2 - n^2}{mn}}$$

$$= \frac{n-m}{\cancel{mn}} \cdot \frac{\cancel{mn}}{m^2 - n^2} = \frac{n-m}{(m-n)(m+n)}$$

$$= \boxed{-\frac{1}{m+n}}$$

7) Simplify the complex fraction completely:

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

$$= \frac{\frac{1}{1}}{\frac{x+1}{x+1} + \frac{1}{x+1}} = \frac{\frac{1}{1}}{\frac{x+2}{x+1}} = \frac{1}{1} \cdot \frac{x+1}{x+2}$$

$$= \boxed{\frac{x+1}{x+2}}$$

8) Solve the following equation for x :

$$x + \frac{9}{x} = 6$$

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Multiply by x
on both sides

$$x\left(x + \frac{9}{x}\right) = 6x$$

$$x^2 + 9 = 6x$$

$$x^2 - 6x + 9 = 0$$

$$(x-3)(x-3) = 0$$

$$\boxed{x=3}$$

9) Solve the following equation for x :

$$\frac{1}{x+2} + \frac{1}{x-2} = \frac{4}{x^2-4}$$

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

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

$$\frac{2x}{(x+2)(x-2)} - \frac{4}{(x+2)(x-2)} = 0$$

2 does not work!!

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

$$x-2=0$$

$$x=2$$

No Solutions

10) A boat that travels 9 km/hr in still water can travel 11 km downstream in the same time as it takes to travel 7 km upstream. Find the speed of the current in the river.

	distance	rate	time
Downstream	11	$9+r$	$\frac{11}{9+r}$
Upstream	7	$9-r$	$\frac{7}{9-r}$

$$\frac{7}{9-r} = \frac{11}{9+r}$$

$$7(9+r) = 11(9-r)$$

$$63 + 7r = 99 - 11r$$

$$18r = 36 \quad \boxed{r=2}$$

11) Jim has scored 4 free throws out of 10 tries. He would like to bring his free throw average up to 70%. How many consecutive free throws should he score in order to bring up his average to 70%?

$$\frac{4+x}{10+x} = \frac{7}{10}$$

$$10(4+x) = 7(10+x)$$

$$40 + 10x = 70 + 7x$$

$$3x = 30$$

$$\boxed{x = 10}$$

12) A perfume is to be mixed in the ratio of 4 drops of pure essence to 7 drops of alcohol. How many drops of pure alcohol should be mixed with 12 drops of essence?

$$\frac{4}{7} = \frac{12}{x}$$

$$4x = 12(7)$$

$$4x = 84$$

$$\boxed{x = 21}$$

THIS PAGE IS LEFT BLANK FOR ANY SCRATCH WORK

END OF TEST