

No notes, books, electronic devices, or outside materials of any kind.

Read each problem carefully and simplify your answers. Unless otherwise indicated, supporting work will be required on every problem; one-word answers will not receive full credit.

Question is from section:

R.8 1. Rationalize the denominator: a (5 pts).  $\frac{-5}{\sqrt{5}}$  b (5 pts).  $\frac{7}{3 + \sqrt{7}}$

R.1, R.8 2 (6 pts). Evaluate the expression:  $1 - 9 \cdot 9^{-3/2}$

1.1 3 (8 pts). Solve for the variable  $a$  in the equation:  $\frac{1}{v} = \frac{2}{a} + \frac{3}{b}$

1.7, 8.1 4 (12 pts). This past weekend, I bought 2 adult movie tickets and 2 children's tickets for a total of \$16. The next customer bought 3 adult tickets and 1 child's ticket for a total of \$17. Find the price of an adult ticket and the price of a child's ticket. Label your answers so I can tell which is which.

R.7 5 (8 pts). Simplify:  $\sqrt[4]{32x^7y^8}$

R.2 6 (9 pts). Simplify the expression:  $\frac{(ux^2)^{-2}x^3y^{-3}y^5}{u^4x^4y^{-5}}$

Express your answer so that all exponents are positive.

R.3 7. The three sides of triangle  $A$  have lengths 4, 4, and 5.

a (4 pts). Is  $A$  a right triangle? No one-word answers. Show supporting work.

b (6 pts). If triangle  $B$  is similar to  $A$ , and two of the sides of  $B$  have length 5 and 5, find the length of the third side of  $B$ .

R.4 or R.6 8a (6 pts). Find the quotient and remainder when  $2x^4 + 4x^3 - 7x^2 + 9$  is divided by  $x + 3$ . Label your answers so I can tell which is which.

" 8b (1 pt). Based on your answer to 8a, is  $x + 3$  a factor of  $2x^4 + 4x^3 - 7x^2 + 9$ ?

No further supporting work required on this part. Circle your answer: Yes No

R.4 9. Expand. Express your answer as a polynomial in standard form.

a (6 pts).  $(2x - 3)^2$  b (10 pts).  $(2x - 3)^3$

R.5 10. Factor completely.

a (6 pts).  $2x^3 + 54$  b (8 pts).  $2(x + 14)^2 - (x + 14)$

c (8 pts).  $x^4 - 13x^2 + 36$  d (8 pts).  $6x^2 - 7x - 24$

1.1 (b) 11. Find all real solutions  $x$ , if any.

1.2 (a, c) a (6 pts).  $2x^2 + 15x = 0$  b (7 pts).  $5(1 - x) = 3(x + 5) + 12$  c (7 pts).  $x^2 + 3x = 7$

12. Perform the indicated operation; reduce your answer to lowest terms.

R.7 a (7 pts).  $\frac{3}{x(x-1)} - \frac{2}{x(x+3)}$  b (7 pts).  $\frac{\frac{x^2-5x+6}{x-5}}{\frac{3x-6}{-2x+10}}$

↑ You won't be provided this information on your exams

1a.  $\frac{-5}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{-5\sqrt{5}}{5} = -\sqrt{5}$ . Alternate form of this question:  $\frac{-7\sqrt{7}}{\sqrt{7}\sqrt{7}} = \dots = -\sqrt{7}$ .  
 1b: see last page

2.  $1 - 9^1 \cdot 9^{-3/2} = 1 - 9^{1-3/2} = 1 - 9^{-1/2} = 1 - \frac{1}{\sqrt{9}} = 1 - \frac{1}{3} = \frac{2}{3}$ .

3. Multiply both sides by  $vab$ ; then solve for  $a$  (alt:  $b$ )

$$vab \cdot \frac{1}{v} = \left(\frac{2}{a} + \frac{3}{b}\right)vab \Rightarrow ab = 2vb + 3va$$

(solve for  $a$ ):

$$\begin{aligned} ab - 3va &= 2vb \\ a(b - 3v) &= 2vb \\ a &= \frac{2vb}{b - 3v} \end{aligned}$$

(solve for  $b$ ):

$$\begin{aligned} ab - 2vb &= 3va \\ b(a - 2v) &= 3va \\ b &= \frac{3va}{a - 2v} \end{aligned}$$

4. Let  $x$  = price of adult ticket, and  $y$  = price child's ticket.

$$\begin{aligned} 2x + 2y &= 16 \rightarrow x + y = 8 \rightarrow y = 8 - x \rightarrow 3x + (8 - x) = 17 \\ 3x + y &= 17 \end{aligned}$$

$$\rightarrow 2x + 8 = 17 \rightarrow 2x = 9 \rightarrow x = \frac{9}{2} = \$4.50. \quad y = 8 - 4.5 = \$3.50$$

Alt form:  $\begin{aligned} 2x + 2y &= 20 \rightarrow x + y = 10 \rightarrow y = 10 - x \rightarrow 3x + (10 - x) = 21 \\ 3x + y &= 21 \end{aligned}$

$$\rightarrow 2x + 10 = 21 \rightarrow 2x = 11 \rightarrow x = \frac{11}{2} = \$5.50. \quad y = 10 - x = \$4.50$$

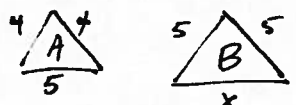
5.  $(2^5 x^7 y^8)^{1/4} = 2^{5/4} x^{7/4} y^{8/4} = 2^{1+1/4} \cdot x^{1+3/4} \cdot y^2 = 2x^{1+3/4} y^2 = 2x^{4/4} \sqrt[4]{2x^3}$

alternate form:  $x \rightarrow y$ . answer =  $2x^2 y^4 \sqrt[4]{2y^3}$

6.  $\frac{u^{-2} x^{-4} y^3 y^{-3} y^5}{u^4 x^4 y^{-5}} = \frac{u^{-2} x^{-4} y^5}{u^4 x^4 y^{-5}} = \frac{y^6}{u^6 x^8}$

alt. form:  $\frac{u^{-2} x^{-4} x^3 y^4 y^5}{u^4 x^5 y^{-5}} = \frac{u^{-2} x^{-1} y^9}{u^4 x^5 y^{-5}} = \frac{y^6}{u^6 x^6}$

7.a.  $4^2 + 4^2 \neq 5^2$  ( $16 + 16 \neq 25$ ) so NO.

7.b.   $\frac{x}{5} = \frac{5}{4} \Rightarrow x = \frac{5}{4} \cdot 5 = \frac{25}{4}$

8a. Can use synthetic division\*:

$$\begin{array}{r|rrrrr} -3 & 2 & 4 & -7 & 0 & 9 \\ & & -6 & 6 & 3 & -9 \\ \hline & 2 & -2 & -1 & 3 & 0 \end{array} \quad \begin{array}{l} Q = 2x^3 - 2x^2 - x + 3 \\ R = 0. \end{array}$$

8b. ( $R=0$ , so) yes, *\*could use long division instead.*

8a. Alt. form: 
$$\begin{array}{r|rrrrr} 3 & 2 & -8 & 5 & 0 & 2 \\ & & 6 & -6 & -3 & -9 \\ \hline & 2 & -2 & -1 & -3 & -7 \end{array} \quad \begin{array}{l} Q = 2x^3 - 2x^2 - x - 3 \\ R = -7 \end{array}$$

8b. ( $R \neq 0$ , so) No.

9a.  $(2x-3)(2x-3) = 4x^2 - 6x - 6x + 9 = 4x^2 - 12x + 9$

b.  $(2x-3)^3 = (2x-3)^2 \cdot (2x-3) = (4x^2 - 12x + 9)(2x-3)$   

$$\left. \begin{array}{l} = 8x^3 - 24x^2 + 18x \\ \quad -12x^2 + 36x - 27 \end{array} \right\} = 8x^3 - 36x^2 + 54x - 27.$$

9. Alternate form:

a.  $(3x-2)(3x-2) = 9x^2 - 12x + 4$

b.  $(3x-2)^2(3x-2) = 27x^3 - 36x^2 + 12x - 18x^2 + 24x - 8 = 27x^3 - 54x^2 + 36x - 8.$

10a.  $2(x^3+27) = 2(x+3)(x^2-3x+9)$  (cube + cube)

alt:  $2(x^3-27) = 2(x-3)(x^2+3x+9)$

10b. Factor out  $(x+14)$ :  $(x+14)(2(x+14)-1) = (x+14)(2x+27)$

alt. form:  $(x+15)(2(x+15)-1) = (x+15)(2x+29)$

$$10c. (x^4 - 13x^2 + 36) = (x^2 - 9)(x^2 - 4) = (x-3)(x+3)(x-2)(x+2).$$

10d. Use trick from our text. seek 2 numbers whose product is  $-6 \cdot 24 (= -2 \cdot 2 \cdot 2 \cdot 3 \cdot 3)$  whose sum is  $-7$ ;  $-16$  and  $9$  will work, now

$$6x^2 - 7x - 24 = 6x^2 - 16x + 9x - 24 = (6x^2 - 16x) + (9x - 24) \\ = 2x(3x - 8) + 3(3x - 8) = (2x + 3)(3x - 8).$$

Alternate form:  $6x^2 + 16x - 9x - 24 = \dots = (2x - 3)(3x + 8)$

$$11a. x(2x + 15) = 0 \Rightarrow x = 0 \text{ or } 2x + 15 = 0 \Rightarrow x = -15/2.$$

alt.  $x(2x + 13) = 0 \Rightarrow x = 0 \text{ or } x = -13/2.$

$$11b. 5 - 5x = 3x + 15 + 12 \Rightarrow 5 - 15 - 12 = 3x + 5x$$

$$\Rightarrow -22 = 8x \Rightarrow x = \frac{-22}{8} = \frac{-11}{4}.$$

alt  $5 - 5x = 3x + 15 + 16 \Rightarrow -26 = 8x \Rightarrow x = \frac{-26}{8} = \frac{-13}{4}.$

$$11c. x^2 + 3x - 7 = 0 \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-3 \pm \sqrt{9 - 4 \cdot 1 \cdot (-7)}}{2} = \frac{-3 \pm \sqrt{37}}{2}$$

alt:  $x^2 - 3x - 7 = 0. \quad x = \frac{3 \pm \sqrt{37}}{2}$

$$12a \quad \frac{3(x+3) - 2(x-1)}{x(x-1)(x+3)} = \frac{3x+9-2x+2}{x(x-1)(x+3)} = \frac{x+11}{x(x-1)(x+3)}$$

$$b. \quad \frac{x^2 - 5x + 6}{x-5} \div \frac{3x-6}{-2x+10} = \frac{(x-2)(x-3)}{x-5} \cdot \frac{-2(x-5)}{3(x-2)} = \frac{-2(x-3)}{3}.$$

$$1b. \quad \frac{7}{3+\sqrt{7}} \cdot \frac{3-\sqrt{7}}{3-\sqrt{7}} = \frac{7(3-\sqrt{7})}{9-7} = \frac{21-7\sqrt{7}}{2}. \quad \text{Alt. form: } \frac{15-5\sqrt{7}}{4}$$

Bonus Points on this test: some problems were graded at more than their stated value. problem: 1b 10c 12b 11b  
added value: +1 +2 +1 +1