

Individual Solutions March 2006 Regional

Question 1 [A]

Common Denominator is $3ab$

$$\frac{3xb + 9ab}{3ab} - \frac{xa - 2a^2}{3ab} - \frac{15ab}{3ab} = 0$$

Group all terms with x

$$x(3b - a) + 9ab + 2a^2 - 15ab = 0$$

$$x(3b - a) + 2a^2 - 6ab = 0$$

$$x(3b - a) = 6ab - 2a^2 = 2a(3b - a)$$

$$x = 2a$$

Question 2 [B]

$$8 = 2^3 \text{ so } 8^x = (2^3)^x = 2^{3x}$$

$$128 = 2^7$$

$$2^{3x} = 2^7 \text{ so } 3x = 7$$

$$x = \frac{7}{3}$$

Question 3 [C]

$$b^3 - 3b^2 + 4b - 12$$

$$b^2(b - 3) + 4(b - 3)$$

$$(b^2 + 4)(b - 3)$$

Question 4 [B]

$$\begin{aligned} \frac{\sqrt{3}}{\sqrt{6} + \sqrt{3}} &= \frac{\sqrt{3}}{\sqrt{6} + \sqrt{3}} \cdot \frac{\sqrt{6} - \sqrt{3}}{\sqrt{6} - \sqrt{3}} = \frac{\sqrt{18} - 3}{6 - 3} \\ &= \frac{3\sqrt{2} - 3}{3} = \sqrt{2} - 1 \end{aligned}$$

Question 5 [A]

Small number = S , Large number = L .

Subtract one third the small number from each number.

$$S - \frac{1}{3}S \text{ and } L - \frac{1}{3}S.$$

$$L - \frac{1}{3}S = 4(S - \frac{1}{3}S) \Rightarrow L - \frac{1}{3}S = 4S - \frac{4}{3}S$$

$$L = 4S - \frac{4}{3}S + \frac{1}{3}S = 4S - S = 3S \text{ or } L = 3S$$

Question 6 [B]

$$\frac{[2(16 - 9)] + [6 + 4(1 - 1)]}{(8 \div 1) - [27 - 24]} = \frac{[2(7)] + [6]}{8 - 3} = \frac{20}{5} = 4$$

Question 7 [C]

$$\frac{26}{495}$$

Question 8 [C]

$$2\gamma 1 = 2^3 - 3 \cdot 1 = 8 - 3 = 5$$

$$3\gamma 5 = 3^3 - 3 \cdot 5 = 27 - 15 = 12$$

Question 9 [D]

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

$$II. \frac{2(x + y)}{2x + 2y} = \frac{2(x + y)}{2(x + y)} = 1$$

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

I and II.

Question 10 [A]

$$m = \frac{8 - 12}{-4 - 7} = \frac{-4}{-11} = \frac{4}{11}$$

Question 11 [B]

$$\frac{1}{5\sqrt{5}}$$

Question 12 [D]

Divide the \$37,000 into 10 parts. Each part is \$3,700. Invest 9 parts in bonds and 1 in stocks. So Mr. Holt must invest $9 \cdot 3700 = \$33,300$ in bonds.

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Question 13 [A]

$$d \cdot 0.10 + q \cdot 0.25 + h \cdot 0.50 = 20$$

$$d + q + h = 110$$

$$6h - 2 = d$$

$$6h - 2 + q + h = 110 \text{ or } 7h + q = 112 \text{ (Equation 1)}$$

$$0.6h - 0.2 + 0.25q + 0.5h = 20$$

$$1.1h + 0.25q = 20.2 \text{ (Equation 2)}$$

Solve system of Equations 1 and 2 and find

$$q = 28$$

Question 14 [B]

$$4320 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 5$$

$$1320 = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 \cdot 11$$

$$\text{Greatest Common Factor} = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 5 = 120$$

Question 15 [B]

$$\text{Slope of } 2x + 8y = 5 \text{ is } -\frac{1}{4}$$

Slope of its perpendicular is 4

$$y - 12 = 4(x - 2) \Rightarrow y - 12 = 4x - 8$$

$$4x - y = -4$$

Question 16 [C]

Draw a Venn Diagram and solve to get 137

Question 17 [D]

$$16 = 0.005 \cdot x \Rightarrow x = 3200$$

Question 18 [B]

$$(2^4)(2^{x+2})(2^9) = 2^{15} \Rightarrow 2^{4+x+2+9} = 2^{15}$$

$$15 + x = 15 \Rightarrow x = 0$$

Question 19 [B]

$$(x + y)^2 - (x - y)^2 = 4xy = 60 - 40 = 20$$

$$\Rightarrow xy = 5$$

$$(x + y)^2 = x^2 + 2xy + y^2 = 60$$

$$x^2 + xy + y^2 = 60 - 5 = 55$$

Question 20 [C]

$$\frac{2 + \sqrt{2}}{2 - \sqrt{2}} \cdot \frac{2 + \sqrt{2}}{2 + \sqrt{2}} = \frac{4 + 4\sqrt{2} + 2}{4 - 2} = \frac{6 + 4\sqrt{2}}{2} = 3 + 2\sqrt{2}$$

Question 21 [B]

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

Question 22 [B]

Question 23 [D]

$$1 \text{ lope} = 2.5 \text{ feet} = 10 \text{ trims}$$

So 1 square lope has 100 square trims

Question 24 [B]

Commutative

Question 25 [B]

b = speed in still water

c = speed of current

$$3.5(b - c) = 15 \Rightarrow 3.5b - 3.5c = 15$$

$$1.25(b + c) = 10 \Rightarrow 3.5b + 3.5c = 28$$

$$7c = 13, c = \frac{13}{7} = 1\frac{6}{7}$$

Question 26 [B]

$$\sqrt[3]{15 \cdot 2^{12} \cdot 4^9 \cdot 8^6 \cdot 16^0} = \sqrt[3]{2^{12} \cdot 4^9 \cdot 8^6} = 2^4 \cdot 4^3 \cdot 8^2 = 2^4 \cdot 2^6 \cdot 2^6 = 2^{16}$$

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Question 27 [A]

$V = \text{volume}$

$$\text{Fillrate} = \frac{V}{20} \text{ per minute}$$

$$\text{Drainrate} = \frac{V}{28} \text{ per minute}$$

$$\text{Both open, net fill rate} = \frac{V}{20} - \frac{V}{28} = \frac{V}{70}$$

$$\text{Filltime} = \frac{V}{\frac{V}{70}} = 70 \text{ minutes} = 1\frac{1}{6} \text{ hours}$$

Question 28 [D]

$$\text{Sum of roots} = \text{Coefficient of } x^4 = 0$$

Question 29 [A]

$$\text{Phillip} = p$$

$$\text{Pedro} = q$$

$$p = \frac{3}{4}q \text{ and } 2(p - 7) - 19 = q - 7$$

$$2p - 14 - 19 = \frac{4}{3}p - 7 \Rightarrow \frac{2}{3}p = 26$$

$$\Rightarrow p = 39 \text{ and } q = 52$$

Question 30 [D]