Q	Parts		Elements of solution	
I	1		If $x=5$ is a root of $P(x)$, then $P(5)=0$ $P(5)=(5)^2-a-3(5-5)(1-5)$	$0=25-a$ Thus, $a=25$
	2	a	$P(x)=x^2-25-3(x-5)(1-x)$ $=x^2-5^2-3(x-5)(1-x)$ $=(x-5)(x+5)-3(x-5)(1-x)$	$=(x-5)[(x+5)-3(1-x)]$ Thus, $P(x)=(x-5)(4x-3)$
		b	To find 2nd root of $P(x)$ we solve $P(x)=0$ So, $(x-5)(4x-3)=0$ If the product of two factors is zero then at least one of them is zero (rule-a)	So, $(x-5)=0$ *or* $(4x-3)=0$ Thus, 2nd root of $P(x)$ is $x=\frac{3}{4}$
		c	$P(x)=(x-5)^2$ $(x-5)(4x-3)=(x-5)^2$ Which is a 2nd degree eqn in one unknown To solve it: we equate to zero then factorize	$(x-5)(4x-3)-(x-5)^2=0$ $(x-5)[(4x-3)-(x-5)]=0$ $(x-5)(3x+2)=0$ (using rule-a) Thus, roots of given equation are $5\ \&\ \frac{-2}{3}$
	3	a	$Q(x)=3(x^2-10x+25)-(10-2x)(x+1)+(x-5)(x+3)$ $=3x^2-30x+75-(10x+10-2x^2-2x)+x^2+3x-5x+15$ $=3x^2-30x+75-8x-10+2x^2+x^2-2x+15$ Thus, $Q(x)=6x^2-40x+80$ Where, $a=6, b=-40\ \&\ c=80$	
		b	$Q(x)$ is a 2nd degree polynomial in x, and it is defined for all real values of x since it is a polynomial(no variables in the lower part and no variable under the radical)	
		c	$Q(x)=6x^2-40x+80$ $Q\left(-\frac{1}{2}\right)=6\left(-\frac{1}{2}\right)^2-40\left(\frac{-1}{2}\right)+80$	$Q\left(-\frac{1}{2}\right)=\frac{3}{2}+\frac{40}{2}+80=\frac{203}{2}$ Which is a decimal fraction, since the denominator is a divisor of 10
	4		$Q(x)=3(x^2-2(x)(5)+(5)^2)+2(x-5)(x+1)+(x-5)(x+3)$ $=3(x-5)^2+2(x-5)(x+1)+(x-5)(x+3)$ $=(x-5)[3(x-5)+2(x+1)+(x+3)]$ $Q(x)=2(x-5)(3x-5)$	
	5	a	Since, $AB=P(x)$ And, $P(x)=(x-5)(4x-3)$	So, $P(5)=(5-5)(4(5)-3)=0$ Then, AB doesn't exist for So, $x=5$
		b	ABC is isosceles A (given) So, $AB=AC$ (legs of an iso. triangle) But, $AB=P(x)\ \&\ AC=Q(x)$ (given)	$(x-5)[(4x-3)-2(3x-5)]=0$ $(x-5)(-2x+7)=0$

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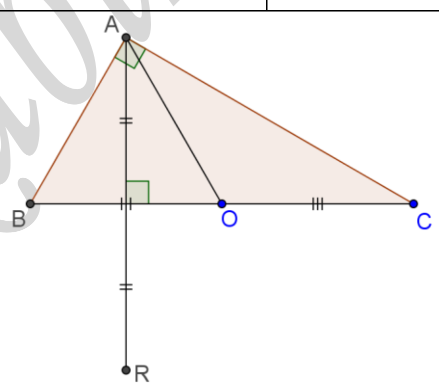
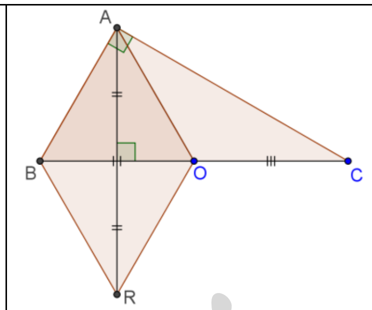
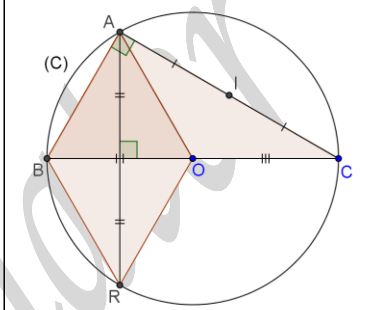
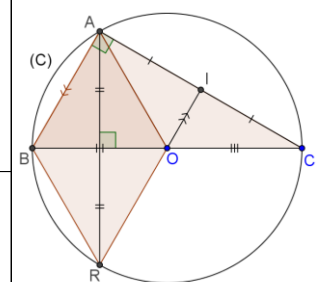
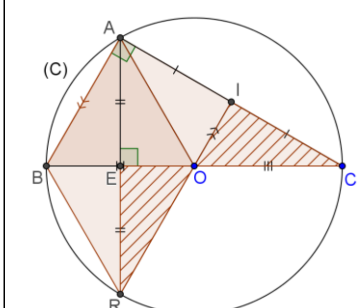
	6		So, $(x-5)(4x-3)=2(x-5)(3x-5)$ $(x-5)(4x-3)-2(x-5)(3x-5)=0$		So, roots are $x=5$ & $x=\frac{7}{2}$ For $x=\frac{7}{2}$ ABC is isosceles A
	6	a	$R(x)$ represents a literal fraction, since there is a variable in its denominator.		
		b	$R(x)$ is defined if $Q(x)\neq 0$ $2(x-5)(3x-5)\neq 0$ (if product is non-zero then none of the factors is zero) $x-5\neq 0$ & $3x-5\neq 0$		So, $x\neq 5$ & $x\neq \frac{5}{3}$ Thus, $R(x)$ is defined for all real values of x except for $x=5$ & $x=\frac{5}{3}$
		c	$R(x)=\frac{(x-5)(4x-3)}{2(x-5)(3x-5)}$ So, $R(x)=\frac{(4x-3)}{2(3x-5)}$		Now, $R\left(\frac{1}{2}\right)=\frac{(2-3)}{3(0.5)-5}$ So, $R\left(\frac{1}{2}\right)=\frac{2}{7}$
		d	$\frac{(4x-3)}{2(3x-5)}=\frac{-2}{3}$ $So, 12x-9=-12x+20$		Hence, $x=\frac{29}{24}$ which is accepted, since it is in domain of $R(x)$
II	1		$AB=\frac{3^{32}-3^{31}}{3^{30}\times 2}$ $AB=\frac{3^{31}(3-1)}{3^{30}\times 2}$	$AB=3cm$ $BC=\frac{4\times 10^{-2}\times 0.5}{0.02\times 30^{-1}}-3(3-1)^3$	$\frac{4\times 5\times 10^{-3}}{2\times 3^{-1}\times 10^{-3}}-3\times 2^3=3\times 10-24$ $BC=6cm$
	2	a	 		
		b	ΔABC is right at A (given) O is the midpoint of $[BC]$ (given)		So, $[AO]$ is a median relative to hypotenuse Hence, $OA=OB=OC$ Thus, $\frac{AO}{BC}=\frac{1}{2}$
		c	In ΔAOB we have: O is the midpoint of $[BC]$ (given) And, $BC=6cm$ (proved) So, $OA=OB=3cm$ (proved)		But, $AB=3cm$ (proved) Thus, ΔAOB is equilateral (having three equal sides)

		d	In quadrilateral $BROA$ we have: R is the symmetric of A w.r.t (BC) (given) So, (BC) is the perpendicular bisector of $[AR]$ Then, $BA = BR$ & $OA = OR$ But, $OA = AB$ (sides of an equilateral triangle) Thus, $BROA$ is a rhombus (having four equal sides)	
3	3	a	Since, ΔABC is right at A (given) O is the midpoint of $[BC]$ (given) Then, O is the center of the circle (C) (C) is circumscribed about ΔABC with center O (proved) So, OA is a radius of (C) But, $OA = OR$ (proved) Thus, R is on (C)	
		b	In ΔABC we have: O is the midpoint of $[BC]$ (given) I is the midpoint of $[AC]$ (given) Thus, (OI) is parallel to (AB) and $OI = \frac{AB}{2} = \frac{3}{2}cm$ (By midpoint theorem: Segment joining midpoints of two sides is parallel to the 3rd side and half of it)	
		c	$BROA$ is a rhombus (proved) So, (OR) is parallel to (AB) (opp. sides of a rhombus) (OI) is parallel to (AB) (proved) So, (OI) is parallel to (OR) (2 lines parallel to same line are parallel) But, O is a common point Thus, the points R, O & I are collinear.	
	4		In ΔARC we have: I is the midpoint of $[AC]$ (given) So, $[RI)$ is a median relative to $[AC]$ (BC) is perp. bisector of $[AR]$ (proved)	So, (BC) is a median relative to $[AR]$ But, (BC) and $[RI)$ intersect at O. Thus, O is the centroid of ΔARC
	5	a	In $\Delta s\ OIC$ & OER we have: $I\hat{O}C = E\hat{O}R$ (vert. opp. angles between intersecting lines) E is the center of rhombus $BROA$ So, E is the midpoint of $[OB]$ So, $OE = \frac{OB}{2}$ And, $OI = \frac{AB}{2}$ (proved) And, $OB = AB$ (sides of equilateral ΔABO)	

			So, $OI = OE$ (half of equals are equal) R is a point on (C) of center O and radius $[OC]$ (proved) So, $OR = OC$ Hence, ΔARC are equal by S.A.S property Thus, $IC = ER$ (by homologous elements)			
		b	$(AB)\parallel(OR)$ (proved) So, $B\hat{A}R = A\hat{R}O$ (alt. interior angles between parallel lines) And, $E\hat{R}O = I\hat{C}O$ (homologous elements) Thus $B\hat{A}R = I\hat{C}O$ (by comparison)			
	6		$P_{BROA} = 4sides$ $= 4(AB)$	Thus, $P_{BROA} = 12cm$		
III	1		$A = \dfrac{8^2 \times 40^{-1}}{2 \times 6^{-1}} + \dfrac{1}{5}$ $= \dfrac{(2^3)^2 \times (2^3 \times 5)^{-1}}{2 \times (2^{-1} \times 3^{-1})} + \dfrac{1}{5}$	$= \dfrac{2^3 \times 5^{-1}}{3^{-1}} + \dfrac{1}{5}$ $= \dfrac{8 \times 3}{5} + \dfrac{1}{5}$ So, $A = 5$	$B = \dfrac{1}{5} + \dfrac{2^{42} + 5 \times 8^{14}}{10 \times 2^{39}}$ $= \dfrac{1}{5} + \dfrac{2^{42} + 5 \times (2^3)^{14}}{5 \times 2 \times 2^{39}}$ $= \dfrac{1}{5} + \dfrac{2^{42}(1+5)}{5 \times 2^{40}}$	$= \dfrac{1}{5} + \dfrac{2^2 \times 6}{5}$ $= 5$ Thus, $A = B$ Choice-C
	2		$x^2 + y^2 = (x+y)^2 - 2xy$ $= (-6)^2 - 2(9)$	$= 36 - 18$ Thus, $x^2 + y^2 = 18$ Choice-B		
	3		$BC = \dfrac{225^2 \times (-120)}{(-75)^3 \times 72 \times 0.1} + 8$ $= \dfrac{(15^2)^2 \times 2^2 \times 3 \times 10}{(5^2 \times 3)^3 \times 3^2 \times 2^3 \times 10^{-1}} + 8$ $= \dfrac{3^5 \times 5^4 \times 2^2 \times 10^2}{5^6 \times 3^5 \times 2^3} + 8$ $= \dfrac{5^2 \times 2^2}{5^2 \times 2} + 8$ So, $BC = 10cm$	$MN = (x+2)^2 - (x-1)^2$ $= x^2 + 4x + 4 - (x^2 - 2x + 1)$ So, $MN = 6x + 3$ But, M & N are respective midpoints of $[AB]$&$[AC]$ (given) So, $MN = \dfrac{BC}{2}$ (By midpoint theorem: segment joining midpoints of two sides of a triangle is half the 3rd side) So, $6x + 3 = 5$ Thus, $x = \dfrac{1}{3}$ accepted Choice-A		
	4		$A_{ABCD} = side^2$ $= AB^2$ $= 36cm^2$ $AE = 1 + \dfrac{4}{9} + \dfrac{1}{2} \div \dfrac{9}{28}$	$DN = DC - NC$ $= 6 - x$ $A_{DMN} = \dfrac{leg_1 \times leg_2}{2}$ $= \dfrac{DM \times DN}{2}$		

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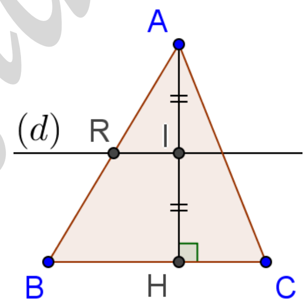
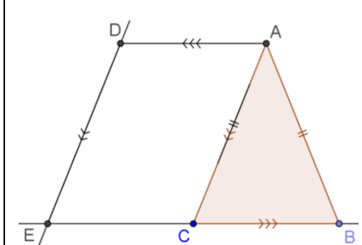
		$=\frac{13}{9}+\frac{1}{2}\times\frac{28}{9}$ $=\frac{13}{9}+\frac{14}{9}$ So, $AE=3cm$ $A_{AEGF}=length\times width$ $=AE\times EG$ $=6cm^2$	$=\frac{2(6-x)}{2}$ $=6-x$ $A_{Shaded}=A_{ABCD}-(A_{AEGF}+A_{DMN})$ $=36-(6+6-x)$ Thus, $A_{Shaded}=24+x\ cm^2$ Choice-A
	5	In quadrilateral $BNCK$ we have: $[AH)$ is a height relative to $[BC]$(given) So, $[AH)\perp(BC)$ And, (d) is the perp. bisector of $[AH]$given) So, $(d)\perp(AH)$ Then, $(d)\parallel(BC)$ (2 lines perp. to same line are parallel) And, (d) is the perp. bisector of $[AH]$at I (given) So, I is the midpoint of $[AH]$ Thus, R is the midpoint of $[AB]$ (By converse of midpoint theorem: line passing through midpoint of a side and parallel to a 2nd side must pass though the midpoint of the 3rd side) Choice-B	
	6	$\left(\frac{3x-4}{2}-\frac{7}{8}=\frac{6x-3}{4}\right)\times 8$ $4(3x-4)-7=2(6x-3)$	$12x-16-7=12x-6$ $0x=17$ Thus, no solution Choice-C
	7	In quadrilateral $ABED$ we have: $(AC)\parallel(DE)$ (given) and, $(AD)\parallel(EC)$(given) So, $ADEC$ is a parallelogram at (having a pair of equal sides) So, $DE=AC$ (opp. sides of a parallelogram) But, ABC is isosceles at A (given) So, $AB=AC$ (legs of an iso. triangle) Hence, $DE=AB$ (By comparison) Thus, $ABED$ is an isosceles trapezoid (having a pair of equal sides & another pair of parallel sides) Choice-B	

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