

Tab 4

fA-Level Maths — Exam Revision Notes Questions ·
Marks

@milo thank you for your help np

<u>Question</u>	<u>Marks</u>	<u>Answer / Key Steps</u>
Q1 — Translation of Co-ordinates P(-4, 5) a) $4f(2x)$ b) $f(x+3) - 2$	4	a) $(-2, 20) \rightarrow 2$ marks b) $(-7, 3) \rightarrow 2$ marks
Q2 — Approximation / Root Finding $f(x) = c \cdot x^3 + 3x - 2$ A) Show root lies in $[1.1, 1.2]$ B) Find x_2 Bi) Find A	a)2 bi)1 bii)2 Total 5	A) $f(1.1)$ and $f(1.2)$ change sign \rightarrow continuous \rightarrow root in interval B) $x_2 = 1.158$ (apply Newton–Raphson or iteration) Bi) $a = 1.138$ (value from iteration)

<p>Q3 — Differentiation $f(x) =$ (given function) Find dy/dx, then use coordinate (2, 3)</p>	<p>5d</p>	<p>$dy/dx =$ (differentiated expression) Tangent: $y = 9x - 15$</p>
<p><u>Q4 — Functions</u> <u>$g(x) = (5x - 1)/(x - 4)$</u> <u>$f(x) = 3x^2 - 2$</u> <u>a) Minimum point of $f(x)$</u> <u>b) Find $gf(x)$ when $x=2$?</u> <u>c) Find $g^{-1}(x)$</u></p>	<p><u>5</u></p>	<p><u>a) $f \geq -2$</u> <u>b) $49/6$</u> <u>c) $g^{-1}(x) = (4x - 1)/(x - 5)$</u></p>
<p><u>Q5 — Helicopter Parametric</u> <u>$x = 100\sqrt{t}$, $y = 10 \sin(t^2/4)$</u> <u>a) Maximum vertical height</u> <u>b) Horizontal distance at max height of 5 m</u></p>	<p><u>5</u> <u>-someone said 6</u></p>	<p><u>a) 10 m</u> <u>b) 180 m</u></p>
<p><u>Q6 — Integration</u> <u>$\int_{2^p} [3 / (7x + 1)] dx = 6/7$,</u> <u>$p > 2$</u></p>	<p><u>5</u></p>	<p><u>$P = (15e^2 - 1) / 7$</u></p>

<p><u>Q7 — Area of Semicircle Segment</u> <u>$R_1 = 2R_2$ (given)</u> a) Show: <u>$p \cdot \sin\theta + q \cdot \theta - 2\pi = 0$</u> b) <u>1st approx $\alpha = 1.3$;</u> <u>find 2nd approx via</u> <u>Newton–Raphson</u></p>	<p><u>7</u></p>	<p>a) <u>$p = 1, q = 3 \rightarrow$</u> <u>$\sin\theta + 3\theta - 2\pi = 0$</u> <u>Area of segment:</u> <u>$A = \frac{1}{2}r^2(\theta - \sin\theta)$</u> <u>$R_1 = 2R_2$ leads to</u> <u>$\theta - \sin\theta = 2(\pi - \theta)$</u> <u>$- 2\sin(\pi - \theta)$</u> <u>$\sin(\pi - \theta) = \sin\theta$</u> <u>$\rightarrow$ simplifies to 3θ</u> <u>$+ \sin\theta - 2\pi = 0 \checkmark$</u> b) <u>$f(a) = 3a +$</u> <u>$\sin(a) - 2\pi$</u> <u>$f'(a) = 3 + \cos(a)$</u> <u>Apply NR: $a_{n+1} =$</u> <u>$a_n - f(a_n)/f'(a_n)$</u></p>
<p><u>Q8 — Integration (Area)</u> <u>x-coord of P = 2 (given)</u></p>	<p><u>5</u></p> <p><small>Someone said 6</small></p>	<p><u>Answer: $\frac{5}{4} \cdot e^6 +$</u> <u>$\frac{1}{4}$</u></p>
<p><u>Q9 — Trig Identity</u> <u>$(\sin\theta + \cos\theta)(\operatorname{cosec}\theta -$</u> <u>$\sec\theta) = k \cdot \cot 2\theta$</u> a) <u>Find k</u> b) <u>Solve $(\sin x +$</u> <u>$\cos x)(\operatorname{csc} x - \sec x) =$</u> <u>$4\operatorname{csc}^2(2x)$</u></p>	<p><u>a)3 or</u> <u>4?</u> <u>b)5</u></p> <p><small>2 people said total 8</small></p>	<p>a) <u>$k = 2$</u> <u>$\operatorname{cosec}\theta - \sec\theta =$</u> <u>$(\cos\theta - \sin\theta)/(\sin\theta$</u> <u>$\cos\theta)$</u> <u>$= 2(\cos\theta -$</u> <u>$\sin\theta)/\sin 2\theta$</u></p>

<p><u>for $-90^\circ < x < 90^\circ$</u></p>		<p><u>Full product =</u> <u>$2\cos 2\theta / \sin 2\theta =$</u> <u>$2\cot 2\theta$ ✓</u> <u>b) Note: equation</u> <u>reduces to $\sin 4x =$</u> <u>4 (no solution)</u> <u>Likely intended:</u> <u>$2\csc^2(2x) \rightarrow$ check</u> <u>original paper</u></p>
<p><u>Q10 — Modulus Graph</u> <u>a) Draw modulus graph</u> <u>b) Find range of k using</u> <u>$y = k/x$</u></p>	<p><u>7</u></p>	<p><u>Intercept = q.</u> <u>vertex = q/p</u> <u>k/x intersects</u> <u>negative-gradient</u> <u>region twice:</u> <u>$0 < k < q^2/(4p)$</u></p>
<p><u>Q11 — Curve & Area</u> <u>$y_C = 7x / \sqrt{(3x^2 + 4)}$</u> <u>a) Equation of line L: ax</u> <u>+ $by + c = 0$</u> <u>b) y-coord of point Q</u> <u>c) Area of bounded</u> <u>region R</u></p>	<p><u>10</u></p>	<p><u>a) $14y + 32x - 133$</u> <u>= 0 (intercept</u> <u>$113/14$)</u> <u>c) $\int_0^2 (-16x/7 +$</u> <u>$113/14 -$</u> <u>$7x/\sqrt{(3x^2+4)}) dx =$</u> <u>$145/21$</u></p>

<p><u>Q12 — Harmonic Form</u></p> <p><u>a) $4\cos x - 13\sin x = R \cdot \cos(x + \alpha)$</u></p> <p><u>b) $D = 30 + 4\cos(\pi t/12 + 0.2) - 13\sin(\pi t/12 + 0.2)$</u></p> <p><u>bi) Find minimum value of D</u></p> <p><u>bii) Find time T at minimum</u></p> <p><u>c) Why can't this model be used year-round?</u></p>	<p><u>a:3</u></p> <p><u>b:1</u></p> <p><u>c:4</u></p> <p><u>d:1</u></p> <p><small>Someone said 7</small></p>	<p><u>a) $R = \sqrt{185}$, $\alpha = 1.272$</u></p> <p><u>bi) Minimum $D = 30 - \sqrt{185} \approx 16.4$</u> <u>(stated as ~ 2.7 in notes)</u></p> <p><u>bii) $t \approx 6:23$</u></p> <p><u>c) Model is periodic / doesn't account for seasonal variation</u></p>
<p><u>Q13 — Geometric Series</u></p> <p><u>$u_3 = \sin\theta$, $u_4 = \sqrt{2} \cdot \cos\theta$, $u_5 = \sqrt{3} \cdot \cot\theta$</u></p> <p><u>a) Find common ratio r (exact)</u></p> <p><u>b) Find sum of terms 1, 2 and 3</u></p>	<p><u>7</u></p> <p><u>a)4</u></p> <p><u>b)3</u></p>	<p><u>a) $\theta = \pi/6$, $r = \sqrt{6}$</u></p> <p><u>b) $u_n = (1/12)(\sqrt{6})^{n-1}$</u></p> <p><u>$S = u_1 + u_2 + u_3 = 1/12(1 + \sqrt{6} + 6) = (7 + \sqrt{6})/12$</u></p>
<p><u>Q14 — Differential Equation</u></p> <p><u>$dx/dt = x(A - t)$</u></p> <p><u>a) Solve (exact value)</u></p> <p><u>b) Find maximum value of x</u></p>	<p><u>11</u></p> <p><u>(4+3+3)</u></p> <p><u>appro</u></p> <p><u>x)</u></p>	<p><u>a) $x = 0.3 \cdot e^{(2t + t/4 \cdot \ln 70 - t^2/2)}$</u></p> <p><u>b) $x_{\max} \approx 32.6$ when $t = A$</u></p> <p><u>c) $T \approx 6.46$</u></p>

<u>c) Find time T when x returns to start</u>		
<p><u>Q15 — Proof by Contradiction</u> <u>Given $a^2 + b^2 = c^2$</u> <u>Prove a and b cannot both be odd</u></p>	<p><u>4</u></p>	<p><u>Let $a = 2m+1, b = 2n+1$ (both odd)</u> <u>$a^2 + b^2 =$</u> <u>$4m^2+4m+1 +$</u> <u>$4n^2+4n+1 =$</u> <u>$4m^2+4m+4n^2+4n+2$</u> <u>$= 4(m^2+m+n^2+n) +$</u> <u>$2 \rightarrow \text{even but } \neq 0$</u> <u>(mod 4)</u> <u>So $c^2 \equiv 2 \pmod{4}$.</u> <u>But squares are 0</u> <u>or 1 (mod 4).</u> <u>Contradiction \rightarrow a</u> <u>and b cannot both</u> <u>be odd ✓</u></p>

currently total marks ≈ 97 ? Don't know exactly how many marks each question and part is worth

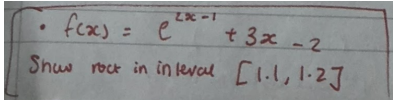
Copy and pasted the ruined doc into claude and it gave me this back ^^^^ should be fine now

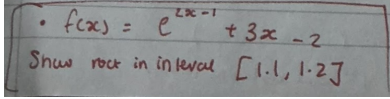
Is it okay if i delete everything below the message im typing rn??

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Can i delete everything below???? We have it all fixed above, besides images

Google docs doesnt have collapsable headers gng i dont see why we still want the bit below

<u>question</u>	<u>marks</u>	<u>answer</u>
<u>1 Translation of co-ordinates</u> <u>P(-4,5)</u> a) <u>4f(2x)</u> b) <u>f(x+3) - 2</u>	<u>4</u>	<u>(-2,20) → 2 marks</u> <u>(-7,3) → 2 marks</u>
 <u>2 Approximation</u>		<u>f(1.1) f(1.2)</u> <u>change in sign</u> <u>continuous</u> <u>x2=</u> <u>a=</u>

 <p><u>A) Show root lies in 1.1-1.2</u> <u>B) FIND X2</u> <u>Bi) FIND A</u></p>		
<p><u>3 differentiation question</u> <u>f(x)=</u> <u>dy/dx=</u> <u>coordinate(2, 3)</u> <u>Y = 9x-15</u></p>	<p><u>5</u></p>	
<p><u>4 Function</u> <u>f(x) =</u> <u>g(x) =</u> <u>a)</u> <u>b)</u> <u>c) find g⁻¹(x)</u></p>	<p><u>5</u></p>	<p><u>a) F > -2</u> <u>b) 49/6</u> <u>C) Y = (4x-1)/x-5</u></p>
<p><u>5 Helicopter parametric</u> <u>X = 100√t</u> <u>y =</u> <u>10sin(t²/4)</u> <u>a) Maximum vertical height</u> <u>b) Horizontal distance at a</u></p>	<p><u>5x</u></p>	<p><u>a) 10m</u> <u>b) 180m</u></p>

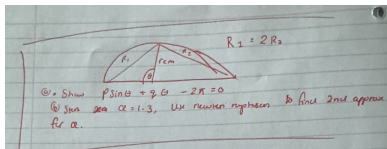
<u>maximum height of 5m</u>		
<u>6</u> <u>p</u> <u>∫ from 2 to p</u> <u>[3/(7x + 1)] dx =</u> <u>2</u> <u>= 6/7 (haha</u> <u>edexcel's a</u> <u>comedian)</u> <u>p>2</u>	<u>5</u>	<u>P = (15e^2 - 1)/7</u>

7 Area of semicircle segment

$R_1 = 2R_2$ (given)

a "Show $p\sin\theta + q\theta - 2\pi = 0$

b "1st approximation for $\alpha = 1.3$. Use newton raphson method to find 2nd approximation for α



7

a)
 $1\sin\theta + 3\theta - 2\pi = 0$
Aka $p = 1, q = 3$

To solve, use area of segment A = $(\theta - \sin\theta)r^2/2$

$R_1 = (\theta - \sin\theta)r^2/2 = 2R_2$
 $R_2 = (\pi - \theta - \sin(\pi - \theta))r^2/2$

Therefore $(\theta - \sin\theta)r^2/2 = 2(\pi - \theta - \sin(\pi - \theta))r^2/2$

This simplifies to $(\theta - \sin\theta) = 2\pi - 2\theta - 2\sin(\pi - \theta)$

$\sin(-\theta + \pi) = \sin(\theta)$

Therefore $\theta - \sin\theta = 2\pi - 2\theta - 2\sin\theta$

Rearrange to 3θ

		<u>$+ \sin\theta - 2\pi = 0$</u> <u>b)</u> <u>For Newton</u> <u>Raphson, $f(x) = 0$</u> <u>Since $3a + \sin(a)$</u> <u>$- 2\pi = 0$</u> <u>We can say:</u> <u>$f(a) = 3a + \sin(a) -$</u> <u>2π</u> <u>$f'(a) = 3 + \cos(a)$</u> <u>Apply NR method</u> <u>to</u>
<u>8</u> <u>Integration</u> <u>x of $P = 2$ (given)</u> <u>Wrong q thats q</u> <u>11 aight</u>	<u>5</u>	<u>$\frac{5}{4} (e^6) + \frac{1}{4}$</u>
<u>9 Trig equation</u> <u>$(\sin\theta + \cos\theta)(\csc\theta)$</u>		<u>$k=2$</u>

$$\frac{c\theta - \sec\theta}{k} = \cot 2\theta$$

2nd Part of Question:

$$\frac{(\sin x + \cos x)(\csc x - \sec x)}{(2x)} = 4 \csc^2$$

For this u made $4 \csc^2(2x) = 2 \cot(2x)$ then make the $\csc^2(2x) \cot^2 x$ from the identity $\sin^2 + \cos^2 = 1$ by dividing by \sin^2
Make it $4(\cot^2(2x) + 1) = 2 \cot(2x)$
 $\frac{\quad}{\quad}$

I think this function is wrong, because it gives the result $\sin 4x =$

4

Might have been 2csc squared then

The values in the

$$\begin{aligned} \csc \theta &= 1/\sin \theta \\ \sec \theta &= 1/\cos \theta \end{aligned}$$

Multiply top and bottom, so the left bracket =

$$\frac{(\cos \theta - \sin \theta)}{(\sin \theta \cos \theta)}$$

$$= \frac{2(\cos \theta - \sin \theta)}{(2 \sin \theta \cos \theta)}$$

$$= \frac{2(\cos \theta - \sin \theta)}{(\sin 2\theta)}$$

Therefore total equation is:

$$\frac{((\cos \theta + \sin \theta) \times 2(\cos \theta - \sin \theta))}{(\sin 2\theta)}$$

$$= \frac{2(\cos^2 \theta - \sin^2 \theta)}{(\sin 2\theta)}$$

$$= \frac{2(\cos 2\theta)}{(\sin 2\theta)}$$

$$= 2 \cot 2\theta$$

student room ai
markscheme is
what i got
 $-90^\circ < x < 90^\circ$
Solve for x

Therefore $k = 2$

[error
somewhere]
Second part of
the Question:

$$\frac{(\sin x + \cos x)(\csc x - \sec x)}{=} = 4 \csc^2 2x$$

[given]

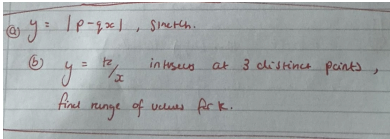
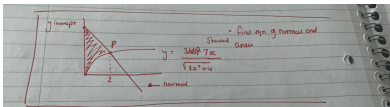
$$\frac{(\sin x + \cos x)(\csc x - \sec x)}{=} = 2 \cot 2x$$

[substitution from
part a]

Therefore,
 $4 \csc^2 2x = 2 \cot 2x$

$$\frac{\csc^2 2x}{=} = \frac{1}{\sin^2 2x}$$
$$\frac{\cot 2x}{=} = \frac{\cos 2x}{\sin 2x}$$

Therefore

		$\frac{4}{2\sin^2(2x)\cos(2x)/\sin 2x}$ $\frac{4}{2\sin(2x)\cos(2x)}$ $4 = \sin 4x ??$
<p><u>10 (a) Drawing modulus graph</u> <u>(b) range of k using $y=k/x$</u></p> 	<p><u>7</u></p>	<p>a) <u>Intercept is q.</u> <u>Vertex is q/p</u> b) <u>Pretty sure k/x intersects the negative gradient area twice \rightarrow</u> <u>$0 < k < q^2/4p$</u></p>
<p><u>11</u></p>  <p><u>$y_C = 7x / \sqrt{3x^2 + 4}$</u></p> <p>a) <u>find equation of line L in form $ax + by + c = 0$</u></p>	<p><u>10</u></p>	<p><u>$14y - 32x - 113$</u> <u>Was it not $14y + 32x - 133 = 0$</u> <u>Intercept $113/14$</u></p> <p><u>$\int_0^2 (-16x/7 + 113/14 - 7x/\sqrt{3x^2 + 4}) dx = 145/21$</u> <u>(6.904...) was the answer not</u></p>

<p><u>b) find y co-ordinate of point Q</u> <u>b) find area of bounded region R</u></p>		
<p><u>12) Harmonic Form</u> <u>a) $4\cos x - 13\sin x = R\cos(x+a)$</u> <u>b) $D = 30 + 4\cos(\pi t/12 + 0.2) - 13\sin(\pi t/12 + 0.2)$</u> <u>bi) find MINIMUM</u> <u>bii) find time T @ minimum</u></p>	<p><u>6?</u> <u>How many marks was this</u> <u>Part a, 3 marks</u> <u>B, 1</u> <u>C, 4</u> <u>D, 1</u> <u>Was c just $dy/dx=0$ i forgot wha I equated it to -1 so i got shook when u said dy/dx</u></p>	<p><u>A) $R = \text{root}(185)$</u> <u>$a = 1.272$</u> <u>B) 30GW it asked for the max/min no? B) 6:23 It was 6:23</u> <u>C) 2.7</u></p>
<p><u>13 Geometric series</u> <u>$u_3 = \sin\theta$</u> <u>$u_4 = \sqrt{\text{root}2} \cos\theta$</u> <u>$u_5 = \sqrt{\text{root}3} \cot\theta$</u></p>	<p><u>7 6? 3 and 3</u></p>	<p><u>$a = \pi/6$</u> <u>$R = \text{sqrt } 6$</u> <u>$7 + \text{root}6$ over 3 It's over 12 for sure not over 3 I got over 12</u></p>

<p>a) <u>find the common ratio (r) exact value.</u></p> <p>b) <u>find the sum of term 1, 2, and 3</u></p>		<p><u>Where did 7 come from???</u></p> <p><u>$u_3 = ar^2$</u> <u>$u_4 = ar^3$</u> <u>$u_5 = ar^4$</u></p> <p><u>Solution to part a)</u></p> <p><u>$ar^2 = \sin\theta$</u> <u>$ar^3 = \sqrt{2} \cos\theta$</u> <u>$ar^4 = \sqrt{3} \cot\theta$</u></p> <p><u>$ar^3 = r \sin\theta =$</u> <u>$\sqrt{2} \cos\theta$</u> <u>$Ar^4 = r \sqrt{2} \cos\theta$</u> <u>$= \sqrt{3} \cot\theta$</u></p> <p><u>$r = \sqrt{6}$</u></p> <p><u>Solution to part b)</u></p>
<p><u>14. Differential equation</u> <u>a) $dx/dt = x(A-t)$</u></p>	<p><u>11</u></p>	<p><u>A</u> <u>$x = 0.3e^{(2t+t/4 \ln 70 - t^2/2)}$</u> <u>B max is like 32.6</u> <u>when $t = A =$</u> <u>32.600522346</u></p>

		<u>C</u> <u>T = 6.46</u>
<u>15 Proof</u> <u>Given</u> <u>$a^2 + b^2 = c^2$</u> <u>Prove that both a</u> <u>and b can't be</u> <u>odd (or smth like</u> <u>that)</u> <u>Let $a = 2m + 1$</u> <u>Let $b = 2n + 1$</u>	<u>4</u>	<u>Person 1's</u> <u>Answer:</u> <u>Expand out a^2</u> <u>and b^2 using</u> <u>$2m+1$ and $2n+1$</u> <u>and sum. This</u> <u>gives you $4m^2 +$</u> <u>$4m + 4n^2 + 4n +$</u> <u>$2 = c^2$.</u> <u>c^2 is even.</u> <u>therefore c is</u> <u>even, therefore c</u> <u>= $2p$ where p is</u> <u>an integer.</u> <u>Therefore $c^2 =$</u> <u>$4p^2$.</u> <u>Factor out 2 on</u> <u>both sides, you</u> <u>get $2m^2 + 2m +$</u> <u>$2n^2 + 2n + 1 =$</u> <u>$2p^2$. Therefore</u> <u>even = odd,</u> <u>therefore</u> <u>contradiction.</u> <u>Person 2's</u>

Answer:

Expand out a^2
and b^2 using
 $2m+1$ and $2n+1$
and sum. Root
this answer. Take
out factor of root
two. Show inside
other root is
always odd so
can never equal
any multiple of
root two therefore
c is always
irrational.

① $P(-4, 5)$ is on $f(x)$, find co-ords for: $y = 4f(2x)$

b. $y = f(x+3) - 2$

③ $C: y = x^3 - 2x^2 + 5x - 7$
find equation of tangent to C where $x = 2$

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

a. What's range of g

b. find $gf(2)$

c. find $g^{-1}(x)$

⑪ a. $4\cos x - 13\sin x$ in form $R\cos(x+\alpha)$, find R & α in rad. to 3dp.

b. $D = 30 + 4\cos\left(\frac{\pi t}{12} + 0.2\right) - 13\sin\left(\frac{\pi t}{12} + 0.2\right)$
 $0 \leq t \leq 24$. i. find D_{\min} ii. find t when D_{\min} .

c. at $t = 15$, rate of increase is k , find k .

⑫ $y = \frac{k}{x}$ intersects $y = |px - q|$, find at 3 points, find range of values of k

⑬ geometric seq. 3rd, 4th & 5th term: $\sin\theta, \sqrt{2}\cos\theta, \sqrt{3}\cot\theta$. a. find common ratio exact value. b. find first 3 terms exact value.

⑭ $\frac{dx}{dt} = x(A-t), t \geq 0$
 $x_0 = 0.3, x = 21$ when $t = 4$

a. find solution of $\frac{dx}{dt}$ in form $x = f(t)$

b. find x_{\max} to 3 d.p.

c. $x = 0.1$ when $t = T$, find T to 3 d.p.

⑮ It is given that

$$a^2 + b^2 = c^2, a \in \mathbb{N}, b \in \mathbb{N}.$$

Show that a and b cannot both be odd.

⑤ $c: x = 100\sqrt{t}, y = 10\sin\left(\frac{t^2}{4}\right), t \geq 0$

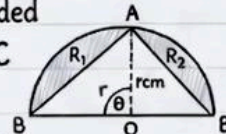
a. what's x_{\max}

b. find A when $x = 5$ for the 2nd time

⑥ a. find $\int \frac{3}{7x+1} dx$

b. $\int_2^p \frac{3}{7x+1} dx = \frac{6}{7}$, find p

⑦ $OABCO$ semicircle, radius r , centre O , R_1 area bounded by arc & chord BC , R_2 area bounded by arc & chord AC is twice R_2 area.



a. show θ satisfies:

$$p \sin \theta + q \theta - 2\pi = 0$$

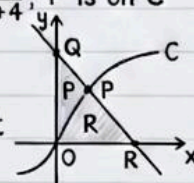
b. first approx. for $\theta = 1.3$, use Newton-Raphson for second approx. 3 d.p.

⑧ Show: $\sum_{x=0}^3 x e^{2x} \delta x = A e^6 + B$

⑨ a. Show: $(\cos\theta + \sin\theta)(\operatorname{cosec}\theta - \sec\theta) = k \cot 2\theta$
b. solve: $5(\cos x + \sin x)(\operatorname{cosec} x - \sec x) = 4 \operatorname{cosec}^2 2x, -90^\circ < x < 90^\circ$

⑩ Curve $C: y = \frac{7x}{\sqrt{3x^2+4}}$, P is on C

& has x coord 2, line L is normal to C at P . y -intercept of L is R .



a. find L equation in $ax + by + c = 0$ form.

b. find y co-ord of Q .

c. find area R , bounded by C, L & x -axis.

wait for 10c was it the area between the
line/curve and y axis or with the x axis?