Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 3 GCE

Centre Number | Candidate Number

Wednesday 13 May 2020

Morning (Time: 2 hours) | Paper Reference **8MA0/01**

Mathematics

Advanced Subsidiary

Paper 1: Pure Mathematics

You must have:
Mathematical Formulae and Statistical Tables (Green), calculator

Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 14 questions in this question paper. The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 6 2 6 4 5 R A 0 1 4 0

Pearson

1. A curve has equation

$$y = 2x^3 - 4x + 5$$

Find the equation of the tangent to the curve at the point $P(2, 13)$.

Write your answer in the form $y = mx + c$, where m and c are integers to be found.

Solutions relying on calculator technology are not acceptable.

(5)

tangent : same gradient, same coordinate, one point of intersection ↔ one root

differentiate $y(x)$: $y = 2x^3 - 4x + 5 \Rightarrow \frac{dy}{dx} = 3 \times 2x^{(3-1)} - 4x^{(1-0)}$

$= 6x^2 - 4$

so gradient @ $P = 6(2)^2 - 4 = 20$

use $y - y_0 = m(x - x_0)$: $y - 13 = 20(x - 2)$

$y - 13 = 20x - 40$

$y = 20x - 27$

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Question 1 continued

(Total for Question 1 is 5 marks)

2. [*In this question the unit vectors* **i** *and* **j** *are due east and due north respectively*.]

A coastguard station O monitors the movements of a small boat.

At 10:00 the boat is at the point $(4\mathbf{i} - 2\mathbf{j})$ km relative to O.

At 12:45 the boat is at the point $(-3\mathbf{i} - 5\mathbf{j})$ km relative to O.

The motion of the boat is modelled as that of a particle moving in a straight line at constant speed.

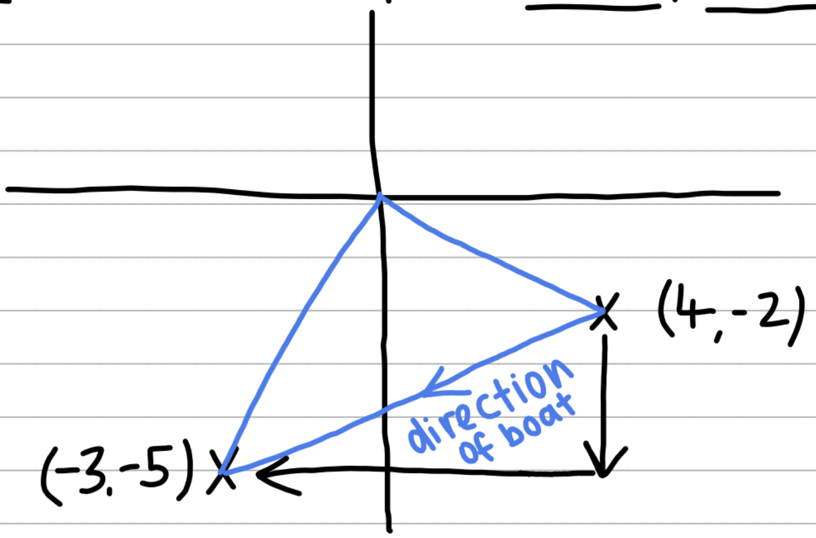
(a) Calculate the bearing on which the boat is moving, giving your answer in degrees to one decimal place.

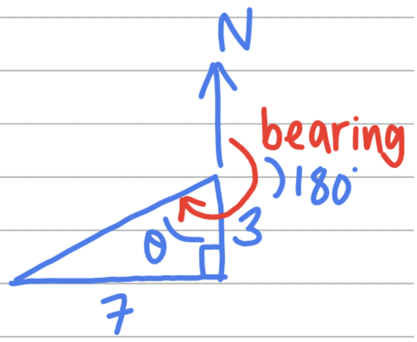
(3)

(b) Calculate the speed of the boat, giving your answer in km h^{-1}

(3)

a) bearing is measured from north, clockwise





direction vector: $\begin{pmatrix}-3\\-5\end{pmatrix} - \begin{pmatrix}4\\-2\end{pmatrix} = \begin{pmatrix}-7\\-3\end{pmatrix}$

angle needed: $\tan\theta = \dfrac{7}{3}$

$= 66.801°$

total bearing $= 180° + 66.8° = \underline{246.8°}$

Question 2 continued

b) to find speed, need distance travelled

direction vector $\begin{pmatrix}-7\\-3\end{pmatrix}$ so distance $= \sqrt{7^2+3^2} = \sqrt{58}$ km

$\sqrt{(4--3)^2+(-2+5)^2}$

time: 2hrs45 $\Rightarrow$ 2.75 hours

speed $= \dfrac{\sqrt{58}}{2.75} = 2.77\,\text{kmh}^{-1}$

(Total for Question 2 is 6 marks)

3. **In this question you must show all stages of your working.**

Solutions relying on calculator technology are not acceptable.

(i) Solve the equation

$$x\sqrt{2} - \sqrt{18} = x$$

writing the answer as a surd in simplest form.

(3)

(ii) Solve the equation

$$4^{3x-2} = \frac{1}{2\sqrt{2}}$$

(3)

i. rearrange to make x the subject:

$x\sqrt{2} - x = \sqrt{18}$

$x(\sqrt{2} - 1) = \sqrt{18}$

$x = \dfrac{\sqrt{18}}{\sqrt{2}-1}$

surd in denominator ⇒ rationalise: $x = \dfrac{\sqrt{18}}{\sqrt{2}-1} \times \dfrac{\sqrt{2}+1}{\sqrt{2}+1}$

$= \dfrac{\sqrt{18}(\sqrt{2}+1)}{2-1}$

$= \dfrac{\sqrt{36}+\sqrt{18}}{1}$

$= 6 + \sqrt{9 \times 2}$

$= 6 + 3\sqrt{2}$

Question 3 continued

ii. LHS has a power of 2, RHS has power of 2 ⇒ Manipulate so 2 is 'base' of each side: $(2^2)^{3x-2} = \frac{1}{2 \times 2^{\frac{1}{2}}}$

$\hookrightarrow 2^{6x-4} = \frac{1}{2^{\frac{3}{2}}} = 2^{-\frac{3}{2}}$

$\therefore \; 6x - 4 = -\frac{3}{2}$

$6x = 2.5 = \frac{5}{2}$

$x = \frac{5}{12}$

(Total for Question 3 is 6 marks)

4. In 1997 the average CO_2 emissions of new cars in the UK was 190 g/km.

In 2005 the average CO_2 emissions of new cars in the UK had fallen to 169 g/km.

Given A g/km is the average CO_2 emissions of new cars in the UK n years after 1997 and using a linear model,

(a) form an equation linking A with n.

(3)

In 2016 the average CO_2 emissions of new cars in the UK was 120 g/km.

(b) Comment on the suitability of your model in light of this information.

(3)

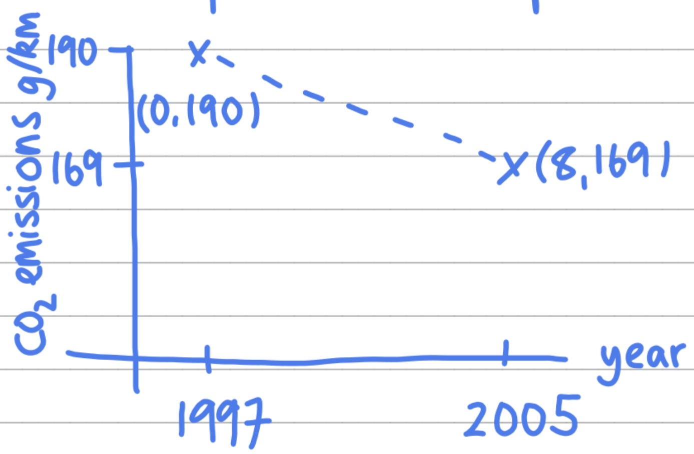
a) linear model: form $A = mn + c$

function of number of years

it can help to visualise problem:

let 1997 be $n=0$

let 2005 be $n=8$



so we want equation of dotted line

gradient: $\dfrac{190-169}{-8} = -2.625$

intercept: $190 = c$

so $A = -2.625n + 190$

b) given new data point, we need to see how it compares with model's prediction:

Question 4 continued

$A = -2.625 \times 19 + 190$

$= 140.125\text{g/km}$

$140.125 \gg 120 \Rightarrow$ the model overestimates A & so is not suitable

(Total for Question 4 is 6 marks)

5.

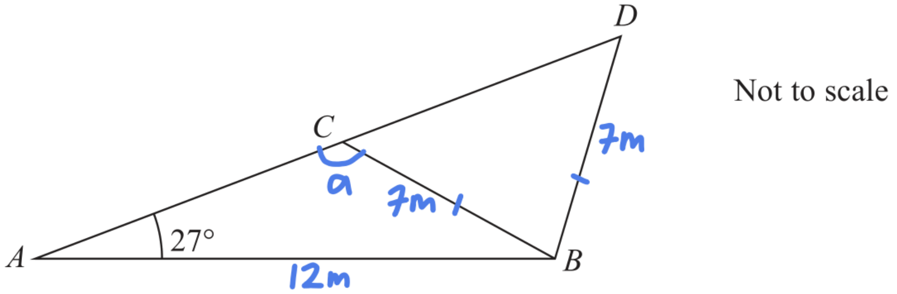


Figure 1

Figure 1 shows the design for a structure used to support a roof.

The structure consists of four steel beams, AB, BD, BC and AD.

Given $AB = 12\,\text{m}$, $BC = BD = 7\text{m}$ and angle $BAC = 27°$

(a) find, to one decimal place, the size of angle ACB.

(3)

The steel beams can only be bought in whole metre lengths.

(b) Find the minimum length of steel that needs to be bought to make the complete structure.

(3)

a) use sine rule : $\dfrac{\sin a}{A} = \dfrac{\sin b}{B}$ ← ratio of sine of angle & opposite side

$\therefore \dfrac{\sin a}{12} = \dfrac{\sin 27°}{7}$

$a = \sin^{-1}\left(\dfrac{12\sin 27°}{7}\right)$

$= 51.1°$ (primary) or $180 - 51.1 = 128.9°$ (secondary)

a is obtuse $\Rightarrow a = 128.9°$

b) use cosine rule to find AD : $a^2 = b^2 + c^2 - 2bc\cos A$

$\measuredangle DCB = 180° - 128.9° = 51.1°$

$\triangle DCB$ is isosceles $\therefore \measuredangle CBD = 180 - 2 \times 51.1° = 77.8°$

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Question 5 continued

$\measuredangle CBA = 180° - 27° - 128.9° = 24.1°$

$\therefore \measuredangle ABD = 24.1° + 77.8° = 101.9°$

(check: $\measuredangle ABD = 180° - 27° - 51.1° = 101.9°$)

$\Rightarrow AD^2 = 7^2 + 12^2 - 2 \times 12 \times 7 \cos 101.9°$

$= 227.64$

$\therefore AD = 15.088\text{ m}$

total length $= 12 + 7 + 7 + 15.09$

$= 41.09$

round up to whole metres: 42m bought

(Total for Question 5 is 6 marks)

P 6 2 6 4 5 R A 0 1 1 4 0

6. (a) Find the first 4 terms, in ascending powers of x, in the binomial expansion of

$$(1 + kx)^{10}$$

where k is a non-zero constant. Write each coefficient as simply as possible.

(3)

Given that in the expansion of $(1 + kx)^{10}$ the coefficient x^3 is 3 times the coefficient of x,

(b) find the possible values of k.

(3)

a) use binomial formula: $(x+y)^n = \sum_0^n \binom{n}{k} x^k y^{n-k}$

$$(1+kx)^{10} = \sum_0^{10} \binom{10}{t} (kx)^t \times 1^{10-t} = 1 + \underbrace{\binom{10}{1}(kx)^1 + \binom{10}{2}(kx)^2 + \binom{10}{3}(kx)^3}_{1^{st}\ 4\ \text{terms}}$$

$$= 1 + 10kx + 45k^2x^2 + 120k^3x^3$$

b) x^3 coeff. $= 3 \times x$ coeff.

$120k^3 = 3 \times 10k$

$= 30k$

$k \neq 0 \Rightarrow$ divide by k: $120k^2 = 30$

$k^2 = \frac{1}{4}$

$\therefore k = \pm \frac{1}{2}$

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P 6 2 6 4 5 R A 0 1 2 4 0

Question 6 continued

(Total for Question 6 is 6 marks)

7. Given that k is a positive constant and $\displaystyle\int_1^k \left(\frac{5}{2\sqrt{x}} + 3\right) dx = 4$

(a) show that $3k + 5\sqrt{k} - 12 = 0$

(4)

(b) Hence, using algebra, find any values of k such that

$$\int_1^k \left(\frac{5}{2\sqrt{x}} + 3\right) dx = 4$$

(4)

a) $\displaystyle\int_1^k \left(\frac{5}{2}x^{-\frac{1}{2}} + 3\right) dx = \left[\left(\frac{5}{2} \div \left(-\frac{1}{2}+1\right)\right)x^{-\frac{1}{2}+1} + \frac{3}{1}x^1\right]_1^k$

$= \left[\left(\frac{5}{2} \div \frac{1}{2}\right)x^{\frac{1}{2}} + 3x\right]_1^k$

$= \left[5x^{\frac{1}{2}} + 3x\right]_1^k$

$= 5\sqrt{k} + 3k - 5 - 3$

$\Rightarrow \quad 4 = 5\sqrt{k} + 3k - 8$

$0 = 5\sqrt{k} + 3k - 12$

b) use $x = \sqrt{k}$: $3x^2 + 5x - 12 = 0$

$(3x - 4)(x + 3) = 0$

$\Rightarrow x = \sqrt{k} = \frac{4}{3}$ or $\sqrt{k} = -3$

reject negative root so $\underline{k = \frac{16}{9}}$

$\displaystyle\int_1^9 \left(\frac{5}{2}x^{-\frac{1}{2}} + 3\right) dx = \left[5\sqrt{x} + 3x\right]_1^9$

$= 5(3) + 3(9) - 5 - 3$

takes +ve root

$= 34 \neq 4$

Question 7 continued

(Total for Question 7 is 8 marks)

8. The temperature, θ °C, of a cup of tea t minutes after it was placed on a table in a room, is modelled by the equation

$$\theta = 18 + 65e^{-\frac{t}{8}} \qquad t \geqslant 0$$

Find, according to the model,

(a) the temperature of the cup of tea when it was placed on the table,
(1)

(b) the value of t, to one decimal place, when the temperature of the cup of tea was 35 °C.
(3)

(c) Explain why, according to this model, the temperature of the cup of tea could not fall to 15 °C.
(1)

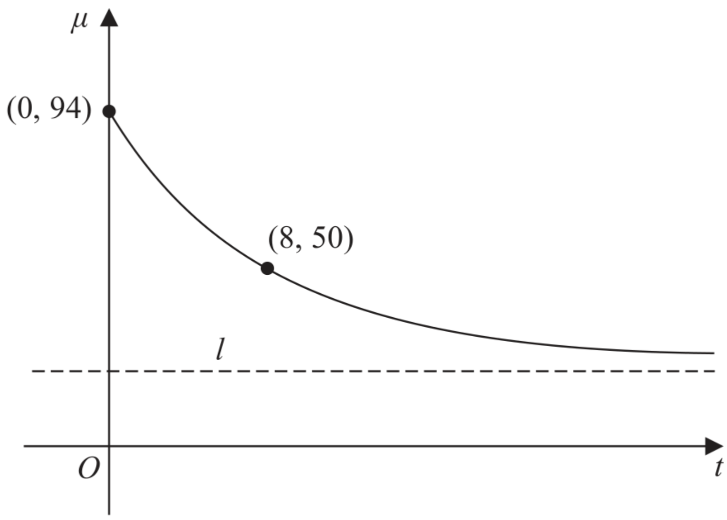

Figure 2

The temperature, μ °C, of a second cup of tea t minutes after it was placed on a table in a different room, is modelled by the equation

$$\mu = A + Be^{-\frac{t}{8}} \qquad t \geqslant 0$$

where A and B are constants.

Figure 2 shows a sketch of μ against t with two data points that lie on the curve.

The line l, also shown on Figure 2, is the asymptote to the curve.

Using the equation of this model and the information given in Figure 2

(d) find an equation for the asymptote l.
(4)

a) placed on table @ $t = 0$: $\theta = 18 + 65e^0$

temperature $= 83$ °C

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Question 8 continued

b) $\theta = 35 = 18 + 65e^{-\frac{t}{8}}$

$\Rightarrow 65e^{-\frac{t}{8}} = 17$

$\Rightarrow e^{-\frac{t}{8}} = \frac{17}{65}$

take ln of both sides : $-\frac{t}{8} = \ln\left(\frac{17}{65}\right)$

$t = -8\ln\left(\frac{17}{65}\right)$

$= 10.729\ldots$

$= 10.7$ (1 d.p.)

c) as $t \to \infty$, $e^{-\frac{t}{8}} \to 0$ from above so $\theta \to 18^{\circ C}$ from above.

hence, the minimum temperature ($18^{\circ C}$) is $> 15^{\circ C}$

d) $\mu = A + Be^{-\frac{t}{8}}$

given points $(0, 94)$ & $(8, 50)$: $94 = A + B^{0} \Rightarrow A + B = 94$ ①

$50 = A + B^{-\frac{8}{8}} \Rightarrow A + Be^{-1} = 50$

① − ②: $94 - 50 = B(1 - e^{-1})$

$44 = B(1 - e^{-1})$

$44e = B(e - 1)$

$B = \frac{44e}{(e-1)}$

Question 8 continued

$$A+B=94 \Rightarrow A=94-\frac{44e}{(e-1)}$$

$$=\frac{94e-44e-94}{e-1}$$

$$=\frac{50e-94}{e-1}$$

as $t\to\infty$, $Be^{-\frac{t}{8}}\to 0$ so asymptote given by

$A=\dfrac{50e-94}{e-1}$ $(=\ell)$

Question 8 continued

(Total for Question 8 is 9 marks)

9.

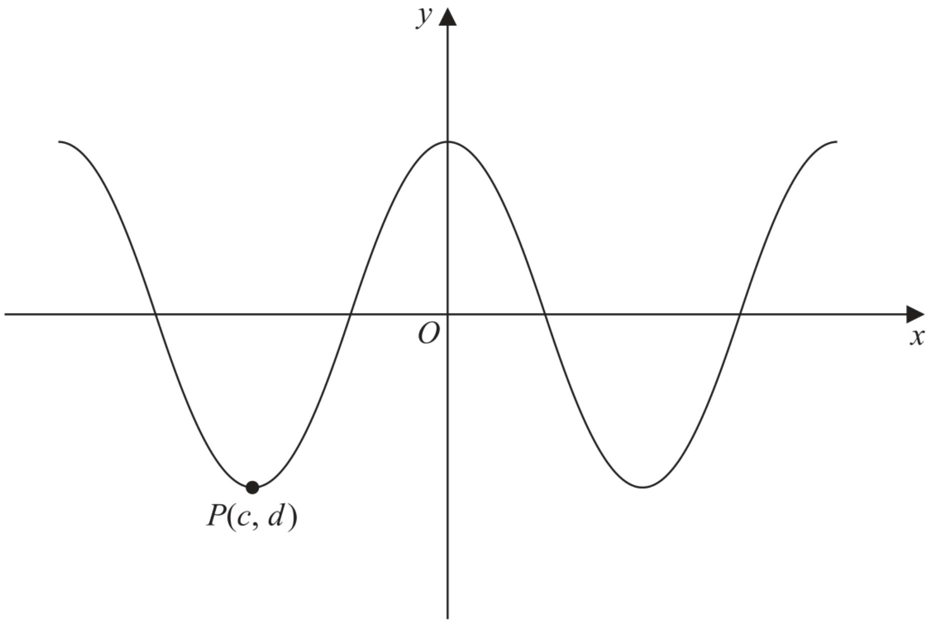

Figure 3

Figure 3 shows part of the curve with equation $y = 3\cos x°$.

The point $P(c, d)$ is a minimum point on the curve with c being the smallest negative value of x at which a minimum occurs.

(a) State the value of c and the value of d.

(1)

(b) State the coordinates of the point to which P is mapped by the transformation which transforms the curve with equation $y = 3\cos x°$ to the curve with equation

(i) $y = 3\cos\left(\dfrac{x°}{4}\right)$

(ii) $y = 3\cos(x - 36)°$

(2)

(c) Solve, for $450° \leqslant \theta < 720°$,

$$3\cos\theta = 8\tan\theta$$

giving your solution to one decimal place.

In part (c) you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

(5)

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Question 9 continued

a) minimum of $\cos x = -1 \Rightarrow$ minimum of $3\cos x = -3 = d$

P is the first minimum for $x<0$ $\therefore$ $c = -180°$

$P(-180°, -3)$

b) i. $y = 3\cos\left(\frac{x°}{4}\right) \rightarrow$ x 'stretched' x 4, no change to y

$\hookrightarrow (-720°, -3)$

ii. $y = 3\cos(x - 36°) \Rightarrow$ translation in x-direction $+36°$

$\hookrightarrow (-144°, -3)$

c) When solving these types of question, list the relevant trig. identities that could help you.

$\tan\theta \equiv \frac{\sin\theta}{\cos\theta}$, $\sin^2\theta + \cos^2\theta \equiv 1$

$$3\cos\theta = 8\tan\theta$$
$$= 8\frac{\sin\theta}{\cos\theta}$$

$\times \cos\theta$: $3\cos^2\theta = 8\sin\theta$

Form quadratic in $\sin\theta$ (you want an equation with only one trig. function)

$$3(1 - \sin^2\theta) = 8\sin\theta$$

Question 9 continued

$$3\sin^2\theta + 8\sin\theta - 3 = 0$$

$$(3\sin\theta - 1)(\sin\theta + 3) = 0$$

$\sin\theta \neq -3$ so $\sin\theta = \frac{1}{3}$ always note what range you need

min. value is -1 $\theta = 19.47°$

but range is $450° \leq \theta < 720°$

$\theta = 180 - 19.47°$ $\sin\theta$ repeats every $360°$

$= 160.53°$

to bring into range: $160.53° + 360° = \underline{520.5°}$ (1 d.p.)

$19.47° + 360°$ also not in range

Question 9 continued

(Total for Question 9 is 8 marks)

10. $$g(x) = 2x^3 + x^2 - 41x - 70$$

(a) Use the factor theorem to show that g(x) is divisible by (x – 5). **(2)**

(b) Hence, showing all your working, write g(x) as a product of three linear factors. **(4)**

The finite region R is bounded by the curve with equation $y = g(x)$ and the x-axis, and lies below the x-axis.

(c) Find, using algebraic integration, the exact value of the area of R. **(4)**

a) factor theorem: if $f(x)$ is divisible by $(x-a)$, then $f(a)=0$

$g(5) = 2\times5^3 + 5^2 - 41\times5 - 70 = 250 + 25 - 205 - 70$

$= \underline{0}$

$g(5)=0 \Rightarrow (x-5)$ is a factor, so $g(x)$ is divisible by $(x-5)$

b) divide $g(x)$ by $(x-5)$ to get a quadratic

$$\begin{array}{r|l} & 2x^2 + 11x + 14 \\ \hline (x-5) & 2x^3 + x^2 - 41x - 70 \\ & -(2x^3 - 10x^2) \\ \hline & \quad 11x^2 - 41x - 70 \\ & \quad -(11x^2 - 55x) \\ \hline & \qquad 14x - 70 \end{array}$$

Question 10 continued

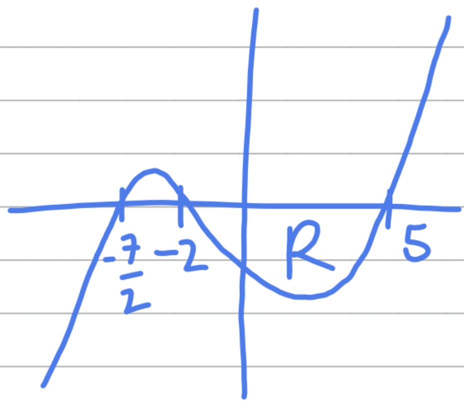
$g(x) = (x-5)(2x^2+11x+14)$

$= (x-5)(2x+7)(x+2)$

Sketch to help you find R

c) g's roots: $-\frac{7}{2}, -2, 5$

so R bound by $x=-2, x=5$



$$\int_{-2}^{5} g(x)\,dx = \int_{-2}^{5} (2x^3 + x^2 - 41x - 70)\,dx$$

$$= \left[\frac{2}{4}x^4 + \frac{1}{3}x^3 - \frac{41}{2}x^2 - 70x\right]_{-2}^{5}$$

$$= \frac{1}{2}(625) + \frac{1}{3}(125) - \frac{41}{2}(25) - 70(5)$$

$$- \frac{1}{2}(16) - \frac{1}{3}(-8) + \frac{41}{2}(4) - 70(-2)$$

$$= -\frac{1525}{3} - \frac{190}{3}$$

area $= 571\frac{2}{3}$

Question 10 continued

Question 10 continued

(Total for Question 10 is 10 marks)

11. (i) A circle C_1 has equation

$$x^2 + y^2 + 18x - 2y + 30 = 0$$

The line l is the tangent to C_1 at the point $P(-5, 7)$.

Find an equation of l in the form $ax + by + c = 0$, where a, b and c are integers to be found.

(5)

(ii) A different circle C_2 has equation

$$x^2 + y^2 - 8x + 12y + k = 0$$

where k is a constant.

Given that C_2 lies entirely in the 4th quadrant, find the range of possible values for k.

(4)

i. complete the square to find centre of circle

$x^2 + y^2 + 18x - 2y + 30 = 0$

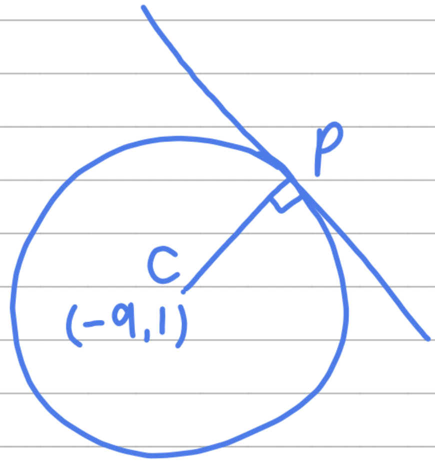
$\hookrightarrow (x+9)^2 - 81 + (y-1)^2 - 1 + 30 = 0$

$\therefore$ centre $(-9, 1)$ (don't need radius)

we can use the fact that the radius & tangent are $\perp$ to find gradient of the tangent : $m_r \times m_l = -1$

gradient of radius joining C to P :

$\frac{7-1}{-5+9} = \frac{3}{2}$



$\therefore m_l = -\frac{2}{3}$

using $y - y_0 = m(x - x_0)$: $y - 7 = -\frac{2}{3}(x+5)$

$3y - 21 = -2x - 10$

Question 11 continued

$\therefore l: 2x+3y-11=0$

ii. lies in 4^{th} quadrant $\Rightarrow$ need centre of C_2

$x^2+y^2-8x+12y+k=0$

$\hookrightarrow (x-4)^2-16+(y+6)^2-36+k=0$

$\rightarrow (x-4)^2+(y+6)^2=52-k$

centre $(4,-6)$

to lie entirely in one quadrant, can't cross axes

$\Rightarrow$ radius must be less than shortest distance from axes

$\therefore r<4 \Rightarrow 52-k<4^2$

$\therefore k>36$ lengths can't be negative

$r>0 \Rightarrow 52-k>0$

so in total, $\underline{36<k<52}$

Question 11 continued

Question 11 continued

(Total for Question 11 is 9 marks)

12. An advertising agency is monitoring the number of views of an online advert.

The equation

$$\log_{10} V = 0.072t + 2.379 \qquad 1 \leqslant t \leqslant 30,\ t \in \mathbb{N}$$

is used to model the total number of views of the advert, V, in the first t days after the advert went live.

(a) Show that $V = ab^t$ where a and b are constants to be found.

Give the value of a to the nearest whole number and give the value of b to 3 significant figures.

(4)

(b) Interpret, with reference to the model, the value of ab.

(1)

Using this model, calculate

(c) the total number of views of the advert in the first 20 days after the advert went live. Give your answer to 2 significant figures.

(2)

a) $\log_{10} V = 0.072t + 2.379$

raise both sides: $V = 10^{0.072t + 2.379}$ (base = 10)

$= 10^{0.072t} \times 10^{2.379}$

$\therefore a = 10^{2.379}$ & $b = 10^{0.072}$

by calculator, nearest whole value: $a = 239$, $b = 1.18$ (3s.f.)

$\Rightarrow V = 239 \times 1.18^t$

b) we get $V = ab$ when $t=1$: $V = ab^1$. thus, the value of ab is the total number of views of the ad. 1 day after it went live

c) $t = 20$: $V = 239 \times 1.18^{20}$

$= 6545\ldots$

Question 12 continued

$\Rightarrow V = 6500$ views

Question 12 continued

Question 12 continued

(Total for Question 12 is 7 marks)

13. (a) Prove that for all positive values of a and b

$$\frac{4a}{b} + \frac{b}{a} \geqslant 4$$

(4)

(b) Prove, by counter example, that this is not true for all values of a and b.

(1)

a) for all real numbers, their value squared is always ≥ 0

$\frac{4a}{b} + \frac{b}{a} = 4 \Rightarrow 4a^2 + b^2 - 4ab = 0 \Rightarrow (2a-b)^2 = 0$

you can 'reverse engineer' to find how to prove statement

starting point for proof

$\therefore (2a-b)^2 \geq 0$

$4a^2 + b^2 - 4ab \geq 0$

as $a, b > 0$, dividing by either doesn't change direction of inequality : $\frac{4a^2}{ab} + \frac{b^2}{ab} \geq \frac{4ab}{ab}$

$\Rightarrow \frac{4a}{b} + \frac{b}{a} \geq 4$

(a) uses $a, b > 0$

b) so counter example must use negative value

e.g. $a = 5, b = -1$: $\frac{4a}{b} + \frac{b}{a} = -20 - \frac{1}{5} < 4$

Question 13 continued

(Total for Question 13 is 5 marks)

14. A curve has equation $y = g(x)$.

Given that

- $g(x)$ is a cubic expression in which the coefficient of x^3 is equal to the coefficient of x
- the curve with equation $y = g(x)$ passes through the origin
- the curve with equation $y = g(x)$ has a stationary point at $(2, 9)$

(a) find $g(x)$,

(7)

(b) prove that the stationary point at $(2, 9)$ is a maximum.

(2)

tick off properties as you go to keep track

a) cubic: $g(x) = ax^3 + bx^2 + cx + d$

x^3 coeff. = x coeff. $\Rightarrow g(x) = \underline{a}x^3 + bx^2 + \underline{a}x + d$

passes through origin $\Rightarrow d = 0$, $g(x) = ax^3 + bx^2 + ax$

passes through $(2,9) \Rightarrow 9 = 8a + 4b + 2a$

$\Rightarrow 10a + 4b = 9$ ①

$(2,9)$ is a stationary point $\Rightarrow g'(2) = 0$

$g'(x) = 3ax^2 + 2bx + a$

$\Rightarrow 0 = 12a + 4b + a$

$13a + 4b = 0$ ②

② − ① : $3a = -9$

$a = -3$

$\Rightarrow b = \dfrac{9 + 10(3)}{4}$

$= \dfrac{39}{4}$

DO NOT WRITE IN THIS AREA

Question 14 continued

so $g(x) = -3x^3 + \frac{39}{4}x^2 - 3x$

b) for a maximum, $g''(x) < 0$

$g''(x) = 2 \times 3x - 3x + 2 \times \frac{39}{4}$

$= -18x + \frac{39}{2}$

$g''(2) = -18(2) + \frac{39}{2}$

$= -\frac{33}{2} < 0$ hence point is a max.

Question 14 continued

(Total for Question 14 is 9 marks)

TOTAL FOR PAPER IS 100 MARKS