Pure Year 2 exam questions (A Level maths)-AQA

NOTE:
Please be aware that in the Year 12 collections, you will find questions from the Year 13 papers. However, these questions are intentionally included because they align with Year 12 content and topics. That's the reason why you are missing some questions here, please have a look at the Year 12 collection!
Happy studying!

Ch 2 Trigonometry

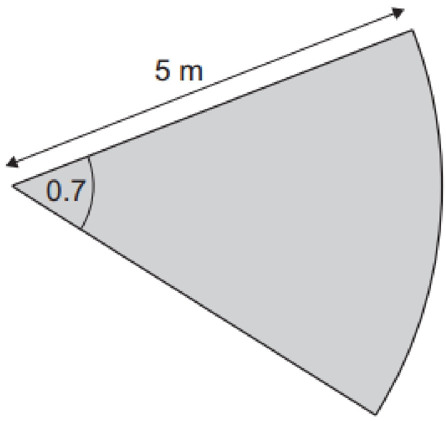
November 2021 Question 5 Paper 3

5 A gardener is creating flowerbeds in the shape of sectors of circles.

The gardener uses an edging strip around the perimeter of each of the flowerbeds.

The cost of the edging strip is £1.80 per metre and can be purchased for any length.

One of the flowerbeds has a radius of 5 metres and an angle at the centre of 0.7 radians as shown in the diagram below.



5 (a) (i) Find the area of this flowerbed.

[2 marks]

5 (a) (ii) Find the cost of the edging strip required for this flowerbed.

[3 marks]

5 (b) A flowerbed is to be made with an area of $20\,\text{m}^2$

5 (b) (i) Show that the cost, £C, of the edging strip required for this flowerbed is given by

$$C = \frac{18}{5}\left(\frac{20}{r} + r\right)$$

where r is the radius measured in metres.

[3 marks]

5 (b) (ii) Hence, show that the minimum cost of the edging strip for this flowerbed occurs when $r \approx 4.5$

Fully justify your answer.

[5 marks]

ANSWER

Q	Marking instructions	AO	Marks	Typical solution
5(a)(i)	Uses formula correctly for area of sector	1.1a	M1	$A=\frac{1}{2}\times 5^2\times 0.7$ $=8.75\,\text{m}^2$
	Obtains 8.75 Condone incorrect or missing units	1.1b	A1	
	Subtotal		**2**	

Q	Marking instructions	AO	Marks	Typical solution
5(a)(ii)	Uses formula for arc length	1.1b	B1	$P=5\times 0.7+2\times 5$ $=13.5$ $Cost=13.5\times 1.80$ $=£24.30$
	Obtains the perimeter by adding twice the radius to their arc length and multiplies their perimeter by 1.80	3.1b	M1	
	Obtains correct cost £24.30 **CAO**	3.2a	A1	
	Subtotal		**3**	

Q	Marking instructions	AO	Marks	Typical solution
5(b)(i)	Forms at least one correct equation for area or perimeter May be embedded in the formulae for C	3.3	M1	$P=r\theta+2r$ $\frac{1}{2}r^2\theta=20$ $\Rightarrow \theta=\frac{40}{r^2}$ $P=\frac{40}{r}+2r$ $C=\frac{40\times 1.8}{r}+2\times 1.8r$ $=\frac{72}{r}+\frac{18}{5}r$ $=\frac{18}{5}\left(\frac{20}{r}+r\right)$
	Eliminates θ from two fully correct equations for area and perimeter to obtain an expression for P in terms of r	3.1b	A1	
	Completes argument to show the required result Accept 3.6 for $\frac{18}{5}$	2.1	R1	
	Subtotal		**3**	

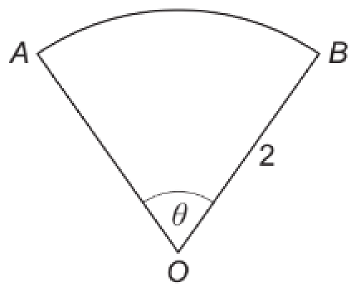
Q	Marking instructions	AO	Marks	Typical solution
5(b)(ii)	Recognises the use differentiation in the model **PI** if $\frac{dC}{dr}$ seen	3.4	B1	$C = \frac{72}{r} + \frac{18}{5}r$ $\frac{dC}{dr} = -\frac{72}{r^2} + \frac{18}{5}$ Minimum occurs when $\frac{dC}{dr}$ =0 $-\frac{72}{r^2} + \frac{18}{5} = 0$ r^2 = 20 $r = \sqrt{20} \approx 4.472..$ Hence $r \approx 4.5$ $\frac{d^2C}{dr^2} = \frac{144}{r^3}$ When $r = \sqrt{20}$, $\frac{d^2C}{dr^2} > 0$ Therefore minimum at $r \approx 4.5$
	Differentiates given model with at least one term correct Condone sign error **OE**	1.1b	M1	
	Explains that a minimum/stationary/turning point occurs when $\frac{dC}{dr} = 0$	2.4	E1	
	Solves $\frac{dC}{dr} = 0$ to find correct exact value or decimal value for r to at least two decimal places	1.1b	A1	
	Uses a gradient test or second derivative or sketches graph to determine nature of stationary point Completes argument to show minimum occurs when $r \approx 4.5$ Must have shown $r \approx 4.5$ in previous step	2.1	R1	
	Subtotal		**5**	

Video solution:

https://youtu.be/26igHZSYDts

November 2020 Question 3 Paper 1

3 The diagram shows a sector OAB of a circle with centre O and radius 2



The angle AOB is θ radians and the perimeter of the sector is 6

Find the value of θ

Circle your answer.

[1 mark]

1 $\sqrt{3}$ 2 3

ANSWER

Q	Marking instructions	AO	Marks	Typical solution
3	Circles the correct answer	2.2a	R1	1
	Total		**1**	

November 2020 Question 4 Paper 2

4 Using small angle approximations, show that for small, non-zero, values of x

$$\frac{x \tan 5x}{\cos 4x - 1} \approx A$$

where A is a constant to be determined.

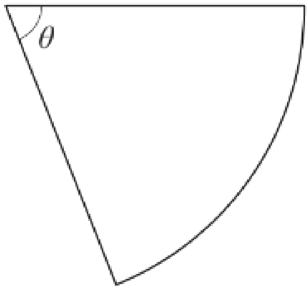
[4 marks]

ANSWER

Q	Marking instructions	AO	Marks	Typical solution
4	Uses or states small angle approximation for $\tan 5x \approx 5x$	1.1b	B1	$\frac{x \tan 5x}{\cos 4x - 1} \approx \frac{x \times 5x}{1 - \frac{(4x)^2}{2} - 1}$ $\approx \frac{5x^2}{-8x^2}$ $\approx -\frac{5}{8}$
	Uses or states small angle approximation for $\cos 4x \approx 1 - \frac{(4x)^2}{2}$ Condone omission of bracket	1.1b	B1	
	Substitutes their expressions Of the form $\tan 5x \approx mx$ and $\cos 4x \approx 1 - \frac{nx^2}{2}$ into $\frac{x \tan 5x}{\cos 4x - 1}$ Condone correct extra terms	1.1b	M1	
	Deduces $A = -\frac{5}{8}$ from a reasoned argument CSO	2.2a	R1	
	Total		**4**	

June 2019 Question 3 Paper 1

3 The diagram below shows a sector of a circle.



The radius of the circle is 4 cm and $\theta = 0.8$ radians.

Find the area of the sector.

Circle your answer.

[1 mark]

1.28 cm^2 3.2 cm^2 6.4 cm^2 12.8 cm^2

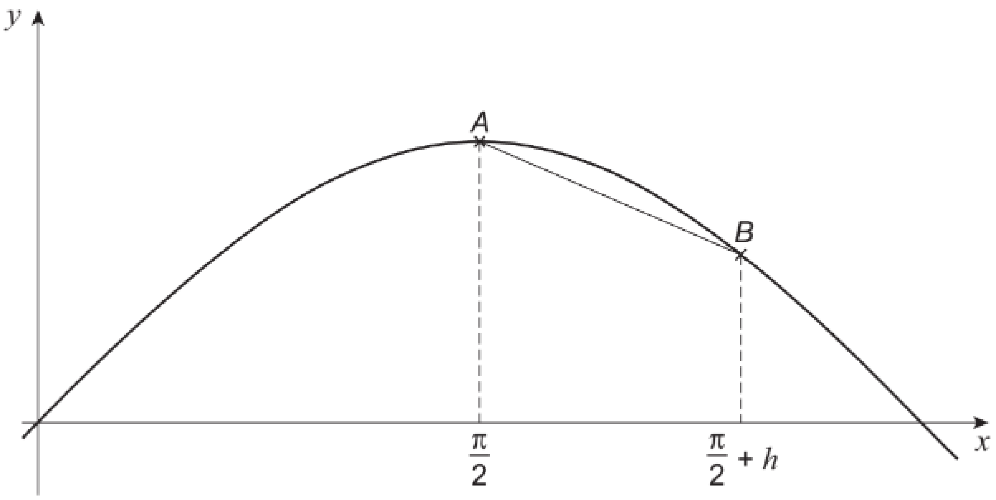
ANSWER

Q	Marking instructions	AO	Mark	Typical solution
3	Circles the correct response	1.1b	B1	6.4 cm^2
	Total		**1**	

June 2019 Question 11 Paper 1

11 Jodie is attempting to use differentiation from first principles to prove that the gradient of $y = \sin x$ is zero when $x = \frac{\pi}{2}$

Jodie's teacher tells her that she has made mistakes starting in Step 4 of her working. Her working is shown below.



Step 1 Gradient of chord $AB = \dfrac{\sin\left(\frac{\pi}{2}+h\right) - \sin\left(\frac{\pi}{2}\right)}{h}$

Step 2 $= \dfrac{\sin\left(\frac{\pi}{2}\right)\cos(h) + \cos\left(\frac{\pi}{2}\right)\sin(h) - \sin\left(\frac{\pi}{2}\right)}{h}$

Step 3 $= \sin\left(\frac{\pi}{2}\right)\left(\dfrac{\cos(h) - 1}{h}\right) + \cos\left(\frac{\pi}{2}\right)\dfrac{\sin(h)}{h}$

Step 4 For gradient of curve at A,

let $h = 0$ then

$\dfrac{\cos(h) - 1}{h} = 0$ and $\dfrac{\sin(h)}{h} = 0$

Step 5 Hence the gradient of the curve at A is given by

$\sin\left(\frac{\pi}{2}\right) \times 0 + \cos\left(\frac{\pi}{2}\right) \times 0 = 0$

Complete Steps 4 and 5 of Jodie's working below, to correct her proof.

[4 marks]

Step 4 For gradient of curve at *A*,

Step 5 Hence the gradient of the curve at *A* is given by

ANSWER

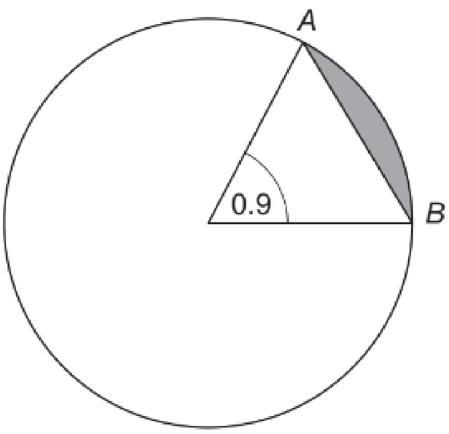
Q	Marking instructions	AO	Mark	Typical solution
11	Replaces $h=0$ with $h\to 0$ or better seen anywhere	2.3	M1	For gradient of curve at *A*, let $h\to 0$ then
	Uses limit notation fully correctly Accept $\frac{\sin(h)}{h}\to 0$ here Accept full limit notation here	2.5	A1	$\frac{\cos(h)-1}{h}\to 0$ and $\frac{\sin(h)}{h}\to 1$
	$\frac{\sin(h)}{h}=1$ seen OE eg $\sin(h)=h$	2.3	B1	
	Writes last line explicitly as $\sin\left(\frac{\pi}{2}\right)\times 0+\cos\left(\frac{\pi}{2}\right)\times 1=0$ Accept $1\times 0+0\times 1=0$	2.2a	B1	Hence the gradient of the curve at A is given by $\sin\left(\frac{\pi}{2}\right)\times 0+\cos\left(\frac{\pi}{2}\right)\times 1=0$
	Total		**4**	

June 2019 Question 5 Paper 3

5 A circle has equation $x^2 + y^2 - 6x - 8y = 264$

AB is a chord of the circle.

The angle at the centre of the circle, subtended by AB, is 0.9 radians, as shown in the diagram below.



Find the area of the minor segment shaded on the diagram.

Give your answer to three significant figures.

[5 marks]

ANSWER

Q	Marking instructions	AO	Mark	Typical solution
5	Uses appropriate method to find radius eg complete the square by using 3^2 or 4^2 on LHS or RHS **PI** by correct radius 17 or 289	3.1a	M1	$(x-3)^2-9+(y-4)^2-16=264$ $(x-3)^2+(y-4)^2=289$ $\frac{1}{2}\times17^2\times0.9=130.05$ $\frac{1}{2}\times17^2\sin0.9=113.19$ Area of segment = 16.9
	Deduces correct radius or radius squared or fully correct completed square form seen	2.2a	A1	
	Uses appropriate method to find area of sector using radius 17 or their stated value of radius or value of radius clearly shown on diagram	1.1a	M1	
	Uses appropriate method to find area of triangle using radius 17 or their stated radius	1.1a	M1	
	Obtains area correct to at least 3 significant figures **AWRT** 16.9	1.1b	A1	
	Total		**5**	

June 2018 Question 5 Paper 3

5 Show that, for small values of x, the graph of $y = 5 + 4\sin\frac{x}{2} + 12\tan\frac{x}{3}$ can be approximated by a straight line.

[3 marks]

ANSWER

Q	Marking Instructions	AO	Marks	Typical Solution
5	Uses small angle approximation for $\sin x$ or $\tan x$ Condone $y = 5 + 4x + 12x$ for this mark	AO1.1a	M1	$y = 5 + 4\sin\frac{x}{2} + 12\tan\frac{x}{3}$ $\sin x \approx x, \tan x \approx x$ $y \approx 5 + 4\left(\frac{x}{2}\right) + 12\left(\frac{x}{3}\right)$ $y \approx 6x + 5$ which is the equation of a straight line.
	Obtains correct equation Allow unsimplified form	AO1.1b	A1	
	Concludes that the graph can be approximated by a straight line. Requires simplification of equation (condone equals) and statement.	AO2.1	R1	
	Total		**3**	