P1 组卷-20260730 — Mark Scheme

Mathematics

Pure Mathematics P1 — Integration

TIME	PAPER REFERENCE(S)	QUESTIONS	TOTAL MARKS
35 minutes	WMA11/01, WMA11/01A	4	27

Q3 Jun 2025 · Q10

10(a)	$m=\frac{4}{5}$	B1
	$y+3=\frac{4}{5}(x-4)$ or $-3=\frac{4}{5}\times 4+c\Rightarrow c=...$	M1
	$y=\frac{4}{5}x-\frac{31}{5}$	A1
		(3)
(b)	$f'(4)=\frac{4}{5}\Rightarrow\frac{k\sqrt{4}(4-3)}{5}=\frac{4}{5}\Rightarrow k=...$	M1
	$k=2$	A1
		(2)
(c)	$(f'(x)=)\frac{2\sqrt{x}(x-3)}{5}=\frac{2x^{\frac{3}{2}}}{5}-\frac{6x^{\frac{1}{2}}}{5}$	M1
	$(f(x)=)\frac{4x^{\frac{5}{2}}}{25}-\frac{4x^{\frac{3}{2}}}{5}(+c)$	M1 A1ft
	$x=4, y=-3\Rightarrow -3=\frac{4(4)^{\frac{5}{2}}}{25}-\frac{4(4)^{\frac{3}{2}}}{5}+c\Rightarrow c=\left(-\frac{43}{25}\right)$	ddM1
	$(f(x)=)\frac{4x^{\frac{5}{2}}}{25}-\frac{4x^{\frac{3}{2}}}{5}-\frac{43}{25}$	A1
		(5)
		(10 marks)

Notes

Mark (a), (b) and (c) together

(a)

B1: States or implies that gradient of tangent (to the curve at *P*) is $\frac{4}{5}$

M1: Uses their **changed** gradient (i.e. not $-\frac{5}{4}$) with $x = 4$ and $y = -3$ where the -3 is their attempt at

finding *y* from $y=-\frac{5}{4}x+2\ =-\frac{5}{4}\times 4+2$ to form the equation of tangent.

E.g. $y+3=\frac{4}{5}(x-4)$ or $y=\frac{4}{5}x+c\Rightarrow -3=\frac{4}{5}\times 4+c\Rightarrow c=...$

Note that some candidates are assuming *P* lies on the *x*-axis and use (4, 0) and this scores M0

A1: $y=\frac{4}{5}x-\frac{31}{5}$ or exact equivalent in this form e.g. $y=0.8x-6.2$ but not $y=\frac{(4x-31)}{5}$ unless the correct form was seen previously then apply isw.

(b)

M1: Uses $f'(4) =$ their **changed** gradient (i.e. not $-\frac{5}{4}$) and solves for *k*.

Allow equivalent work e.g. uses $f'(4) \times -\frac{5}{4} = -1$ and solves for *k*.

A1: $k = 2$

Correct answer with no working scores both marks.

(c)

M1: Attempts to expand and writes $f'(x)$ in the form $\alpha x^{\frac{3}{2}} + \beta x^{\frac{1}{2}}$

M1: Integrates with at least one index correct i.e. $...x^{\frac{3}{2}} \to ...x^{\frac{5}{2}}$ or $...x^{\frac{1}{2}} \to ...x^{\frac{3}{2}}$ which must come from correct work but indices may be unprocessed at this stage.

A1ft: Correct integration with or without the $+c$. Allow with constant *k* or follow through on an incorrect *k* only i.e. the expression should be otherwise correct e.g. allow $\frac{2kx^{\frac{5}{2}}}{25} - \frac{2kx^{\frac{3}{2}}}{5}(+c)$ or this expression with their *k* substituted. Need not be simplified at this stage so indices may be unprocessed.

The "f(*x*) =" is **not** required. Condone spurious integral signs.

ddM1: Must have a constant of integration now. It is for using $x = 4$ and $y = -3$ in their $(f(x) =) \frac{4x^{\frac{5}{2}}}{25} - \frac{4x^{\frac{3}{2}}}{5} + c$ in an attempt to find their *c*, where the -3 is their attempt at finding *y* from $y = -\frac{5}{4}x + 2$

Many candidates are assuming *P* lies on the *x*-axis and use (4, 0) and this scores ddM0

Depends on both previous M marks.

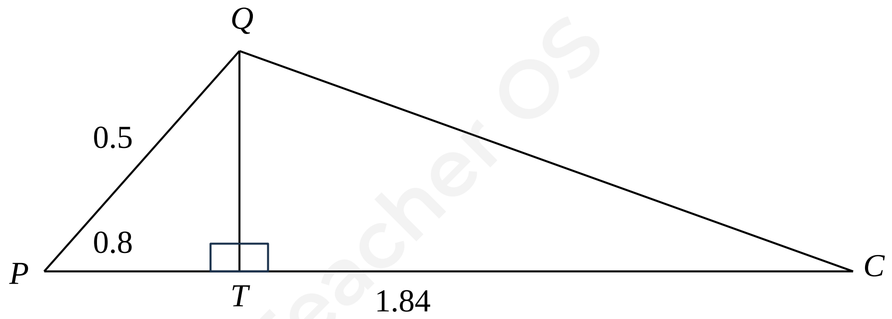
A1: $(f(x) =) \frac{4x^{\frac{5}{2}}}{25} - \frac{4x^{\frac{3}{2}}}{5} - \frac{43}{25}$

Correct simplified expression. The "f(*x*) =" is **not** required.

Condone spurious integral signs.

Apply isw if necessary once a correct expression is seen.

Question 9(a) and (b) using right angled triangles:



(a)

e.g. $QT = 0.5\sin 0.8 (= 0.3586...)$, $PT = 0.5\cos 0.8 (= 0.3483...)$

$$QC = \sqrt{QT^2 + CT^2} = \sqrt{0.3586...^2 + (1.84 - 0.3483...)^2} = 1.534$$

Score M1 for a complete and correct method leading to a value for the length of *QC* and A1 as MS

(b)

e.g. $\sin PCQ = \frac{QT}{CQ} = \frac{0.5\sin 0.8}{1.534} = 0.23379... \Rightarrow PCQ = 0.236*$

Score M1 for a complete and correct method leading to an expression for e.g. sin *PCQ* and A1 for a correct proof.

Q4 Jan 2023 · Q11

11(a)	States or implies that the gradient of the normal is $-\frac{1}{3}$	M1
	Correct equation of normal e.g. $y-16=-\frac{1}{3}(x-4)$	A1
		(2)
(b)	$f''(x)=4x+x^{-\frac{1}{2}} \Rightarrow f'(x)=2x^2+2x^{\frac{1}{2}}+c$	M1
	$x=4, f'(x)=3 \Rightarrow\ 3=32+4+c \Rightarrow c=...(-33)$	dM1
	$f'(x)=2x^2+2x^{\frac{1}{2}}-33$	A1
	$f'(x)=2x^2+2x^{\frac{1}{2}}-33 \Rightarrow f(x)=\frac{2}{3}x^3+\frac{4}{3}x^{\frac{3}{2}}-33x+d$	dM1
	$x=4, f(x)=16 \Rightarrow (f(x)=)\frac{2}{3}x^3+\frac{4}{3}x^{\frac{3}{2}}-33x+\frac{284}{3}$	ddM1A1
		(6)
		(8 marks)

(a)

M1: States or implies that the gradient of the normal is $-\frac{1}{3}$

A1: Finds the <u>equation</u> of the normal $y-16=-\frac{1}{3}(x-4)$ o.e. e.g. $y=-\frac{1}{3}x+\frac{52}{3}$, $3y+x-52=0$

But **not** $\frac{y-16}{x-4}=-\frac{1}{3}$.

Requires a full correct equation. Apply isw once a correct equation is seen.

(b) Award marks if work in (b) is seen in (a).

M1: Attempts to integrate $f''(x)$ once with one index correct. E.g. $4x \to ...x^2$ or $\frac{1}{\sqrt{x}} \to ...x^{\frac{1}{2}}$

dM1: Applies $f'(4)=3$ and solves to find a constant of integration. **Depends on first M1**.

A1: $(f'(x)=)2x^2+2x^{\frac{1}{2}}-33$ or obtains $(f'(x)=)2x^2+2x^{\frac{1}{2}}+c$ with c correctly calculated as -33

Ignore labelling of the function e.g. they may call it $f(x)$

dM1: **Dependent upon first M1 only**. For an attempt to integrate $f''(x)$ twice and achieve a form

$(f(x)=)ax^3+bx^{\frac{3}{2}}+...$ where ... could be 0. Ignore labelling of the function e.g. they may call it $f(x)$

dddM1: **Dependent upon all previous M's**. It is for using $f(4)=16$ (may be implied) to find the constant of integration.

A1: $(f(x)=)\frac{2}{3}x^3+\frac{4}{3}x^{\frac{3}{2}}-33x+\frac{284}{3}$ or exact equivalent. Apply isw once a correct **expression** is seen.

The "$\mathrm{f}(x) =$" is not required and ignore any label they may have given it.

Also allow $\left(\mathrm{f}(x) =\right)\frac{2}{3}x^{3} + \frac{4}{3}x^{\frac{3}{2}} - 33x + c$ with c correctly calculated as $\frac{284}{3}$.

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