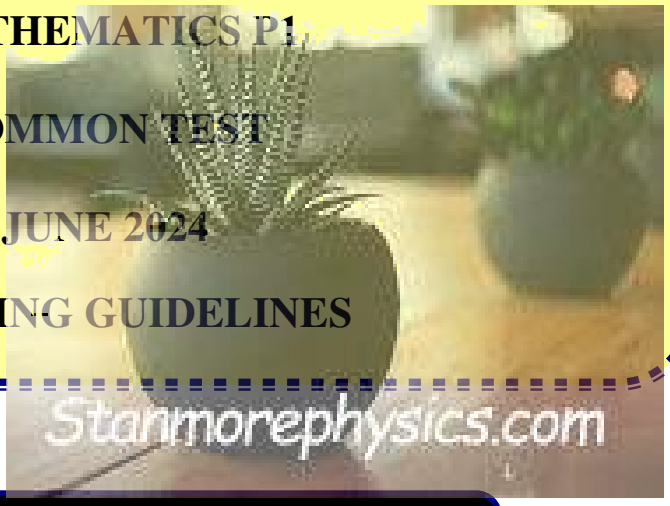
KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

MATHEMATICS P1

COMMON TEST

JUNE 2024

MARKING GUIDELINES



NATIONAL SENIOR CERTIFICATE

GRADE 12

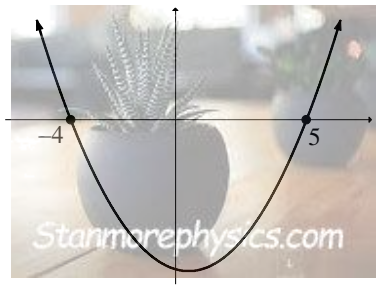
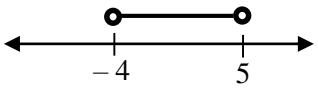
MARKS: 150

These marking guidelines consist of 13 pages.

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GRADE 12
Marking Guideline

QUESTION 1

1.1.1	$x=0$ or $-\frac{7}{2}$ or 8	✓ A answer ✓ A answer ✓A answer (3)
1.1.2	$(x+1)(x+12)=0$ $x=-1$ or $x=-12$	✓A factors ✓CA answer ✓CA answer (3)
1.1.3	$5x^2-7x+8=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{7\pm\sqrt{(-7)^2-4(5)(8)}}{2(5)}$ $x=\frac{7\pm\sqrt{-111}}{10}$ No real values of x Accept: No solution	✓A substituting in formula ✓CA answer (2)
1.1.4	$\sqrt{x-2}+2=x$ $\left(\sqrt{x-2}\right)^2=(x-2)^2$ $x-2=x^2-4x+4$ $x^2-5x+6=0$ $(x-2)(x-3)=0$ $x=2$ or $x=3$ Answers only: 2 marks	✓A isolating $\sqrt{x-2}$ ✓CA squaring both sides ✓CA standard form ✓CA answer ✓CA answer (5)
1.1.5	$x^2-x-20<0$ $(x+4)(x-5)<0$  **OR**  $-4<x<5$ OR $x\in(-4\,;5)$ Penalty of 1 mark if one or both end points are included	✓A standard form ✓CA critical values CA✓ CA✓ answer (4)

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1.1.6	$2^{1-2x}+7.2^{-x}-4=0$ $2.2^{-2x}+7.2^{-x}-4=0$ $\left(2.2^{-x}-1\right)\left(2^{-x}+4\right)=0$ $2^{-x}=\frac{1}{2}$ or $2^{-x}=-4$ $2^{-x}=2^{-1}$ no solution $x=1$ **OR** $2^{1-2x}+7.2^{-x}-4=0$ $2.2^{-2x}+7.2^{-x}-4=0$ Let $2^{-x}=k$ $(2k-1)(k+4)=0$ $k=\frac{1}{2}$ or $k=-4$ $2^{-x}=2^{-1}$ no solution $x=1$	✓A splitting exponents ✓A factor ✓A factor ✓A answer ✓A no solution (5) **OR** ✓A splitting exponents ✓A factor ✓A factor ✓A answer ✓A no solution (5)
1.2	$22-3m\geq 0$ $22\geq 3m$ $\frac{22}{3}\geq m$ $m=7$	✓A $22-3m\geq 0$ ✓CA $\frac{22}{3}\geq m$ ✓CA answer (3)
1.3	$\frac{\sqrt{9.9^{2023}}}{\sqrt{9^{2023}}-\sqrt{9^2.9^{2023}}}$ $=\frac{3\sqrt{9^{2023}}}{\sqrt{9^{2023}}(1-9)}$ $=-\frac{3}{8}$	✓A simplifying numerator ✓A simplifying denominator ✓CA answer (3)
1.4	$y=2x-3$ $4x^2+(2x-3)^2-2x(2x-3)-7=0$ $4x^2+4x^2-12x+9-4x^2+6x-7=0$ $4x^2-6x+2=0$ $2x^2-3x+1=0$ $(2x-1)(x-1)=0$ $x=\frac{1}{2}$ or $x=1$ $y=2\left(\frac{1}{2}\right)-3$ or $y=2(1)-3$ $y=-2$ $y=-1$	✓A making y the subject of the formula ✓CA substitution ✓CA standard form ✓CA factors ✓CA x-values ✓CA y-values

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	OR $x = \frac{y+3}{2}$ $4\left(\frac{y+3}{2}\right)^2 + y^2 - 2y\left(\frac{y+3}{2}\right) - 7 = 0$ $y^2 + 3y + 2 = 0$ $(y+1)(y+2) = 0$ $y = -2 \quad \text{or} \quad y = -1$ $x = 1 \quad \text{or} \quad x = \frac{1}{2}$	✓A making x the subject of the formula ✓CA substitution ✓CA standard form ✓CA factors ✓CA y-values ✓CA x-values (6)
		[34]

QUESTION 2

2.1	$-5\ ;\ 12\ ;\ 27\ ;\ 40\ ;\ 51\ldots$ $17\ ;\ 15\ ;\ 13\ ;\ 11\ ;\ \ldots$ $-2\ ;-2\ ;-2\ ;\ \ldots$ The next two terms are 40 and 51	✓A ✓A answer (2)
2.2	$-5\ ;\ 12\ ;\ 27\ ;\ 40\ ;\ 51\ldots$ $17\ ;\ 15\ ;\ 13\ ;\ 11\ ;\ \ldots$ $-2\ ;-2\ ;-2\ ;\ \ldots$ $2a=-2$ $a=-1$ $17=3a+b$ $17=3(-1)+b$ $b=20$ $-5=-1+20+c$ $c=-24$ $T_n=-n^2+20n-24$	✓ A $a=-1$ ✓CA value of b ✓CA value of c ✓CA answer (4)
2.3	$51=-n^2+20n-24$ $n^2-20n+75=0$ $(n-5)(n-15)=0$ $n=5$ or $n=15$ $\therefore T_5$ and T_{15} If stopping at values of n, still award the last mark	✓CA equating T_n to 51 ✓CA standard form ✓CA answers (3)
2.4	$\sum_{n=3}^{10} T_n - \sum_{n=11}^{17} T_n$ Using symmetry: $T_3=T_{17}$; $T_4=T_{16}$ $T_5=T_{15}$; etc. $(T_3-T_{17})+(T_4-T_{16})+(T_5-T_{15})+(T_6-T_{14})+$ $(T_7-T_{13})+(T_8-T_{12})+(T_9-T_{11})+T_{10}$ $=0+0+0+0+0+0+0+76$ $=76$ **OR** Listing all the terms from $\sum_{n=3}^{10} T_n$. Listing all the terms from $\sum_{n=11}^{17} T_n$ $\sum_{n=3}^{10} T_n - \sum_{n=11}^{17} T_n = 76$	✓CA✓CA = terms, using symmetry ✓CA answer (3) **OR** ✓CA Listing all the terms from $\sum_{n=3}^{10} T_n$ ✓CA Listing all the terms from $\sum_{n=11}^{17} T_n$ ✓CA answer (3)
		[12]

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QUESTION 3

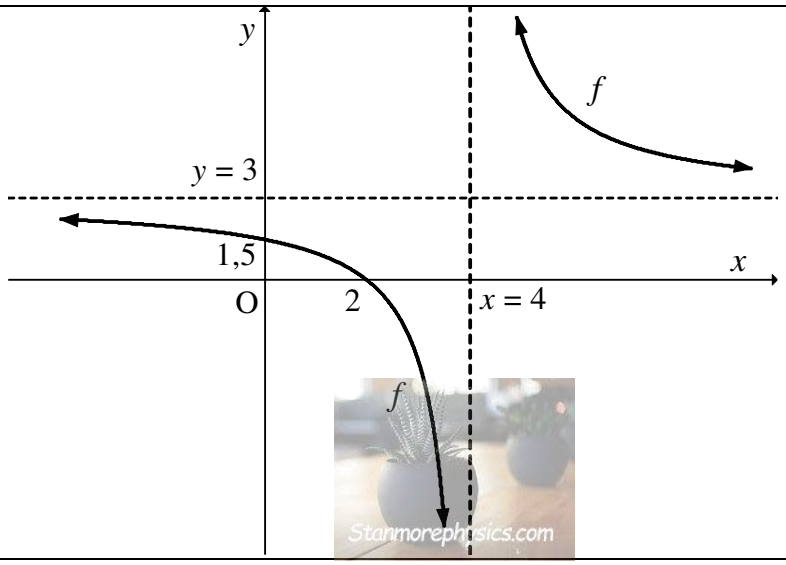
3.1.1	$-\frac{7}{2}\ ;\ -3\ ;\ -\frac{5}{2}\ ;\ \ldots.$ $a=-\frac{7}{2}$ $d=\frac{1}{2}$ $T_n=a+(n-1)d$ $T_n=-\frac{7}{2}+(n-1)\frac{1}{2}$ $T_n=-\frac{7}{2}+\frac{1}{2}n-\frac{1}{2}$ $T_n=\frac{1}{2}n-4$	✓A value of d ✓CA answer (2)
3.1.2	$S_n=\frac{n}{2}\left[2a+(n-1)d\right]$ $675=\frac{n}{2}\left[2\left(\frac{-7}{2}\right)+(n-1)\frac{1}{2}\right]$ $1350=n\left(-7+(n-1)\frac{1}{2}\right)$ $2700=-14n+n^2-n$ $0=n^2-15n-2700$ $(n-60)(n+45)=0$ $n=60$ or $n=-45$ $\therefore n=60$ only	✓CA substitute into formula ✓CA factors ✓CA values of n ✓CA answer (4)
3.1.3	$T_n=\left(\frac{1}{2}n-4\right)^2$ $T_n=\frac{1}{4}n^2-4n+16$ $n=-\frac{b}{2a}$ $n=-\frac{-4}{2\left(\frac{1}{4}\right)}$ $n=8$ The 8th term is the smallest **OR** Smallest value of $\left(\frac{1}{2}n-4\right)^2=0$ $\frac{1}{2}n-4=0$ $n=8$ The 8th term is the smallest	✓CA squaring T_n ✓CA substituting in $n=-\frac{b}{2a}$ ✓CA answer (3) **OR** ✓CA squaring T_n ✓CA equating T_n to 0 If stopping at values of n, still award the last mark ✓CA answer (3)

3.2.1	$r = 2(x+1)$ $-1 < r < 1$ $-1 < 2(x+1) < 1$ $-\frac{1}{2} < x+1 < \frac{1}{2}$ $-\frac{3}{2} < x < -\frac{1}{2}$	✓A $r = 2(x+1)$ ✓A $-1 < r < 1$ ✓CA answer (3)
3.2.2	$a = \frac{-3}{4} + 1$ $a = \frac{1}{4}$	✓A answer (1)
3.2.3	$r = \frac{1}{2}$ $a = \frac{1}{4}$ $T_n = ar^{n-1}$ $T_n = \frac{1}{4}\left(\frac{1}{2}\right)^{n-1}$ $\sum_{n=1}^{\infty} \frac{1}{4}\left(\frac{1}{2}\right)^{n-1}$ Answer only: Full marks	✓CA value of r. ✓CA expression of T_n ✓CA answer (3)
3.2.4	$S_\infty = \frac{a}{1-r}$ $= \frac{\frac{1}{4}}{1-\frac{1}{2}}$ $= \frac{1}{2}$	✓CA substitute in S_∞ formula ✓CA answer (2)
		[18]

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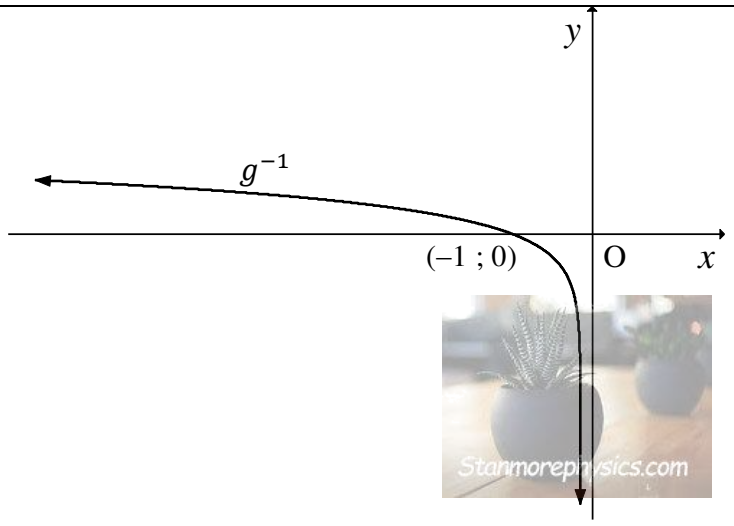
QUESTION 4

4.1	$f(x)=\frac{6}{x-4}+3$	✓A $\frac{6}{x-4}$ ✓A $+3$ (2)
4.2	For x-intercept: $0=\frac{6}{x-4}+3$ $-3=\frac{6}{x-4}$ $-3x+12=6$ $-3x=-6$ $x=2$ For y-intercept: $y=\frac{6}{0-4}+3$ $=\frac{3}{2}$	✓ CA equating to zero ✓ CA x-intercept ✓ CA y-intercept (3)
4.3		✓A shape ✓A asymptotes ✓CA intercepts (3)
4.4	$y=-x+c$ $3=-4+c$ $c=7$ $y=-x+7$ Answer only: Full marks	✓A substituting $m=-1$ ✓A substituting $(4\ ;\ 3)$ ✓CA answer (3)
4.5	(5;10)	✓CA ✓CA answer (2)
		[13]

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QUESTION 5

DO NOT MARK QUESTIONS 5.5, 5.6 AND 5.7.

5.1	B$(1\,;-9)$	A✓ x-coordinate A✓ y-coordinate (2)
5.2	$x<1$	A✓ answer (1)
5.3	$(x-1)^2-9=0$ $(x-1)^2=9$ $(x-1)=\pm 3$ $x=1\pm 3$ $x=4$ or $x=-2$ $(4\,;0)$ or $(-2\,;0)$ **OR** $(x-1)^2-9=0$ $x^2-2x+1-9=0$ $x^2-2x-8=0$ $(x-4)(x+2)=0$ $x=4$ or $x=-2$ $(4\,;0)$ or $(-2\,;0)$	✓A equating to zero ✓A taking square root on both sides ✓CA answers (3) **OR** ✓A equating to zero ✓A factors ✓CA answer (3)
5.4	$y=-a^x$ $-9=-a^1$ $a=9$	✓A substituting $(1\,;-9)$ (1)
5.5	$g: y=-9^x$ $g^{-1}: x=-9^y$ $-x=9^y$ $\therefore y=\log_9(-x)$	✓A swapping x and y ✓A answer
5.6		✓CA shape ✓CA x-intercept

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5.7	$y=\log_9(-x)$ $2=\log_9(-x)$ $-x=9^2$ $x=-81$ $\therefore x<-81$	✓CA $2=\log_9(-x)$ ✓CA value of x ✓CA answer
		[7]

QUESTION 6

6.1	$y=a(x+6)(x-2)$ Substitute $(-4\ ;\ 6)$: $6=a(-4+6)(-4-2)$ $6=-12a$ $a=-\frac{1}{2}$ $\therefore y=-\frac{1}{2}(x+6)(x-2)$ $y=-\frac{1}{2}x^2-2x+6$ $\therefore b=-2$ and $c=6$	A✓ $y=a(x+6)(x-2)$ A✓ substitute $(-4\ ;\ 6)$ A✓ $6=-12a$ A✓ substitute back $a=-\frac{1}{2}$ (4)
6.2	$x=-\frac{b}{2a}$ **OR** $=-\frac{(-2)}{2\left(-\frac{1}{2}\right)}$ $x=\frac{-6+2}{2}$ $=-2$ $=-2$ Maximum value = $h(-2)=-\frac{1}{2}(-2)^2-2(-2)+6=8$	A ✓ substitution A✓ x-value of TP CA✓ answer (3)
6.3	$y=-\frac{1}{2}x+c$ Substitute $(-4\ ;\ 6)$: $6=-\frac{1}{2}(-4)+c$ $c=4$ $\therefore y=-\frac{1}{2}x+4$ **OR** $s(x)=-\frac{1}{2}x+4$	✓A substitution ✓CA answer (2)
6.4	$k<2$	✓✓CA CA answer (2)
6.5	Translated downwards by 8 units	✓✓CA CA answer (2)
		[13]

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QUESTION 7

Penalise once only for incorrect notation in Question 7.1.1

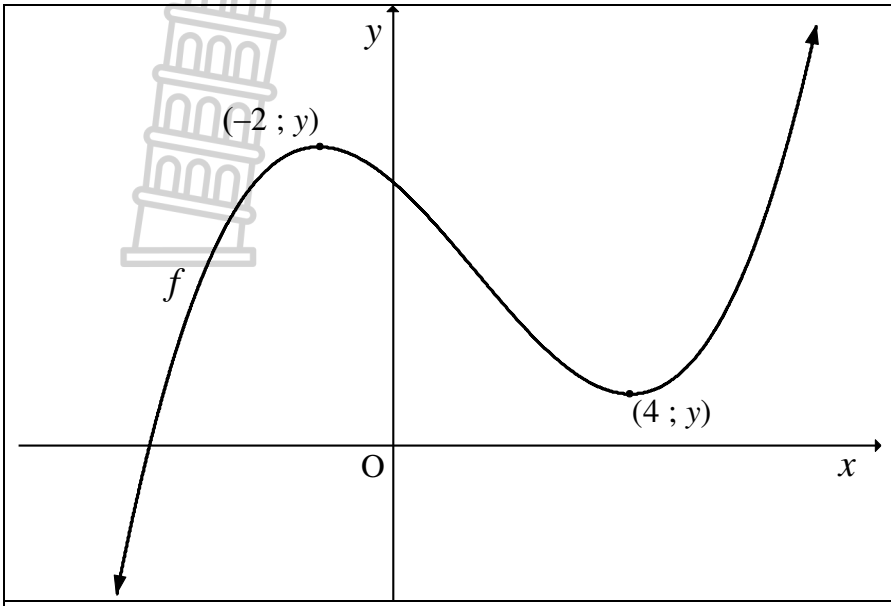
7.1.1	$f(x)=2x^2+4$ $f(x+h)=2(x+h)^2+4=2x^2+4xh+2h^2+4$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $f'(x)=\lim_{h\to 0}\frac{2x^2+4xh+2h^2+4-2x^2-4}{h}$ $f'(x)=\lim_{h\to 0}\frac{4xh+2h^2}{h}$ $f'(x)=\lim_{h\to 0}\frac{h(4x+2h)}{h}$ $f'(x)=\lim_{h\to 0}(4x+2h)$ $f'(x)=4x$	✓A value of $f(x+h)$ ✓CA substitution into formula ✓CA simplifying ✓CA factors ✓CA answer (5)
7.1.2	$f'(x)=m_{\text{tangent}}$ $\therefore 4x=-12$ $x=-3$ $y=2(-3)^2+4=22$ The tangent is at $(-3\ ;\ 22)$ $y=-12x+c$ $22=-12(-3)+c$ $c=-14$ $y=-12x-14$	✓CA $4x=-12$ ✓CA coordinates of contact point ✓CA substitution of point and gradient ✓CA answer (4)
7.2.1	$f(x)=\frac{2x^2-5x-12}{x-4}$ $=\frac{(2x+3)(x-4)}{x-4}$ $=2x+3$ $f'(x)=2$	✓A factors ✓CA answer ✓CA answer (3)
7.2.2	$D_x\left[x^{\frac{2}{5}}+x^2-9x\right]$ $=\frac{2}{5}x^{\frac{-3}{5}}+2x-9$	✓A $x^{\frac{2}{5}}$ ✓CA $\frac{2}{5}x^{\frac{-3}{5}}$ ✓A $+2x$ ✓A -9 (4)
7.2.3	$y=\frac{x}{6}-\frac{6}{x}$ $=\frac{x}{6}-6x^{-1}$ $\frac{dy}{dx}=\frac{1}{6}+6x^{-2}$	✓A $-6x^{-1}$ ✓A $\frac{1}{6}$ ✓CA $+6x^{-2}$ (3)
		[19]

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QUESTION 8

8.1	For x-intercepts: $-x^3+10x^2-17x-28=0$ $\therefore x^3-10x^2+17x+28=0$ $(x+1)(x^2-11x+28)=0$ $(x+1)(x-4)(x-7)=0$ $\therefore x=-1$ or $x=4$ or $x=7$ $A(-1\,;0)$; $B(4\,;0)$; $C(7\,;0)$ Answer only: 3 marks	✓A $(x+1)$ ✓CA trinomial ✓CA factors ✓CA answer (4)
8.2	For the turning points: $f'(x)=-3x^2+20x-17=0$ $3x^2-20x+17=0$ $(3x-17)(x-1)=0$ $x=\frac{17}{3}$ or $x=1$ $y=\frac{400}{27}$ or $y=-36$ $D(1\,;-36)$; $E\left(\frac{17}{3}\,;\frac{400}{27}\right)$	✓A $f'(x)=-3x^2+20x-17$ ✓CA $f'(x)=0$ ✓CA coordinates of D ✓CA coordinates of E (4)
8.3.1	x-coordinate of point of inflection $=\frac{1+\frac{17}{3}}{2}$ $=\frac{1+\frac{17}{3}}{2}$ $=\frac{10}{3}$ Therefore: The graph is concave down for $x>\frac{10}{3}$ **OR** At point of inflection: $f''(x)=-6x+20=0$ $\therefore 6x=20$ $x=\frac{10}{3}$	✓CA method to calculate x-value of point of inflection ✓CA x-value ✓CA answer (3)
8.3.2	$x<\frac{10}{3}$	✓✓ CA CA answer (2)
		[13]

QUESTION 9

	✓A shape ✓A turning point at $x = -2$ ✓A turning point at $x = 4$ ✓A one x-intercept ✓A y-intercept above x-axis (5)
	[5]

QUESTION 10

10.1	Total area $= 2\left(\frac{1}{2}\pi r^2\right) + (x \times 2r)$ $400 = \pi r^2 + 2xr$ $2xr = 400 - \pi r^2$ $x = \frac{400 - \pi r^2}{2r}$	✓A formula for area ✓A equating to 400 (2)
10.2	Length $= 2(\pi r) + 2x$ $L(r) = 2(\pi r) + 2\left(\frac{400 - \pi r^2}{2r}\right)$ $= 2\pi r + \frac{400 - \pi r^2}{r}$ $= \frac{2\pi r^2 + 400 - \pi r^2}{r}$ $= \frac{400}{r} + \pi r$	✓A formula for perimeter ✓A substitution ✓A simplification (3)

10.3	$L(r) = 400r^{-1} + \pi r$ $\frac{dL}{dr} = -400r^{-2} + \pi$ For a minimum: $\frac{dL}{dr} = -400r^{-2} + \pi = 0$ $\frac{1}{r^2} = \frac{\pi}{400}$ $r^2 = \frac{400}{\pi}$ $r = \sqrt{\frac{400}{\pi}}$ $= 11,28\,m$	✓A derivative ✓CA equating to zero ✓CA r^2 subject of formula ✓CA answer (4)
		[9]

TOTAL: 143

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