KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS

MARKING GUIDELINES

COMMON TEST

MARCH 2024

Examplephysics.com

MARKS: 100

These marking guidelines consist of 10 pages.

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QUESTION 1			
1.1.1	8 ; 15 ; 22 ; …….. $a=8;\quad d=7;\quad n=36$ $T_n=a+(n-1)d$ $T_{36}=8+(36-1)(7)$ $T_{36}=253$	✓A substitution ✓CA answer	(2)
1.1.2	$a=8;\quad d=7;\quad n=36$ $S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{36}=\frac{36}{2}[2(8)+(36-1)(7)]$ $S_{36}=4698$ **OR** $S_n=\frac{n}{2}(a+l)$ $S_{36}=\frac{36}{2}(8+253)$ $=4698$	✓CA substitution ✓CA answer **OR** ✓CA substitution ✓CA answer	(2)
1.1.3	$T_n=a+(n-1)d$ $T_{72}=8+(72-1)(7)=505$ $T_{72-m}=8+(72-m-1)(7)$ $T_{72-m}+T_{72}=786$ $505+8+497-72-m=786$ $-7m=-224$ $m=32$	✓CA value of T_{72} ✓CA Substitution in T_{72-m} ✓CA Simplification ✓CA value of m	(4)
1.2.1	$81\times\frac{2}{3}=54cm$ The next jump is $54cm$	✓A answer	(1)
1.2.2	81 ; 54 ; 36 ; ……. $a=81;\quad r=\frac{2}{3};\quad n=9$ $T_n=ar^{n-1}$ $T_9=81\left(\frac{2}{3}\right)^8$ $=\frac{256}{81}=3{,}16\,cm$	✓A substitution ✓A answer	(2)

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1.2.3	$S_\infty = \frac{a}{1-r}$ $S_\infty = \frac{81}{1-\frac{2}{3}}$ $= 243\text{cm}$ $243\text{ cm} > 230\text{cm}$ Yes he will be able to catch the insect **OR** Showing that he can reach a distance > 230 through **substitution of a value of *n* that is ≥ 8** in the S_n formula.	✓A substitution ✓CA value of S_∞ ✓CA conclusion **OR** ✓A substitution ✓CA value of S_n ✓CA conclusion	(3)
			[14]

QUESTION 2			
2.1.1	$16\ ;\ 0\ ;\ -12\ ;\ -20\ ;\ \ldots\ldots$ $-16\ ;\ -12\ ;\ -8\ ;\ \ldots\ldots$ $4\ ;\quad 4\ ;\ \ldots\ldots$ $2a = 4$ $a = 2$ $-16 = 3a + b$ $-16 = 3(2) + b$ $b = -22$ $16 = 2 - 22 + c$ $c = 36$ $T_n = 2n^2 - 22n + 36$	✓A value of a ✓CA value of b ✓CA value of c ✓CA answer	(4)
2.1.2	$32\ ;\ 28\ ;\ 24\ ;\ 20\ ;\ \ldots\ldots$ $a = 32$ $d = -4$ $T_n = a + (n-1)d$ $T_n = 32 + (n-1)(-4)$ $T_n = -4n + 36$ **Answer only: Full marks**	✓A substitution ✓CA answer	(2)
2.1.3	$2n^2 - 22n + 36 = -4n + 36$ $2n^2 - 18n = 0$ $n^2 - 9n = 0$ $n(n-9) = 0$ $n = 0$ or $n = 9$ $n = 9$ only $\therefore T_{17}$ and T_{18} are the terms	✓CA equating ✓CA factors ✓CA $n = 9$ only ✓CA answer	(4)

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2.2	$T_1 = -54$; $T_2 = 162$; $T_3 = -486$ $a = -54$; $r = -3$; $n = 7$ $S_n = \frac{a(r^n - 1)}{r - 1}$ $S_7 = \frac{-54((-3)^7 - 1)}{-3 - 1}$ $= -29538$ **Answer only: Full marks**	✓A $a = -54$ ✓A $r = -3$ ✓CA substitution ✓CA answer	(4)
			[14]

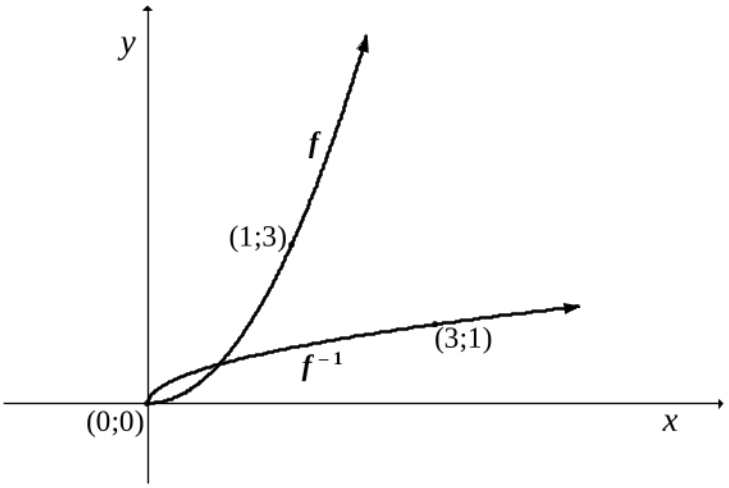
QUESTION 3			
3.1	$x = -2$ $y = 1$	✓A answer ✓A answer	(2)
3.2	$0 = \frac{3}{x+2} + 1$ $-1 = \frac{3}{x+2}$ $-x - 2 = 3$ $x = -5$ A$(-5\ ;\ 0)$	✓A substituting $y = 0$ ✓ A value of x	(2)
3.3	$y = \frac{3}{0+2} + 1$ $y = \frac{5}{2}$ B$\left(0\ ;\ \frac{5}{2}\right)$ **Answer only: Full marks**	✓A substituting $x = 0$ ✓ A value of y	(2)
3.4	$g(x) = \frac{3}{-x+2} + 1 + 2$ $g(x) = \frac{-3}{x-2} + 3$ **OR** $g(x) = \frac{3}{-x+2} + 3$ **Answer only: Full marks**	✓A $-x$ ✓A answer **OR** ✓A✓A answer	(2)
3.5	$y = x + c$ $3 = 2 + c$ subst$(2;3)$ $c = 1$	✓A substituting $(2;3)$ ✓CA answer	(2)
			[10]

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QUESTION 4			
4.1	$y = mx + 5$ B(0 ; 5): y-intercept OB = 5 units OA = OB – AB = 5 – 2 = 3 units A(0 ; 3) $f(x) = -x^2 + 2x + 3$ $p = 3$	✓A 5 – 2	(1)
4.2	$x = \frac{-b}{2a}$ $x = \frac{-2}{2(-1)}$ $= 1$ $y = -(1)^2 + 2(1) + 3 = 4$ F(1; 4) **OR** $f(x) = -\left[x^2 - 2x - 3\right]$ $f(x) = -\left[(x^2 - 2x + 1) - 3 - 1\right]$ $f(x) = -\left[(x-1)^2 - 4\right]$ $f(x) = -(x-1)^2 + 4$ F(1; 4)	✓A substitution ✓CA value of x ✓CA value of y **OR** ✓A completing the square ✓CA value of x ✓CA value of y	(3)
4.3	$f(x) = -x^2 + 2x + 3$ $0 = x^2 - 2x - 3$ $0 = (x-3)(x+1)$ $x = 3$ or -1 C(3 ; 0)	✓A equating to 0 ✓A factors ✓CA answer	(3)

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4.4	C(3 ; 0) CD = 7 units OD = 7 + 3 = 10 units D(10 ; 0) $y = mx + 5$ **or** $m = \frac{y_2 - y_1}{x_2 - x_1}$ $0 = 10m + 5$ $= \frac{0 - 10}{5 - 0}$ $m = -\frac{1}{2}$ $= -\frac{1}{2}$ $y = -\frac{1}{2}x + 5$ **or** $C\hat{D}E = 180° - \angle$ of incl of DE At E: $x = 3$ $= 26,57°$ $\therefore y = -\frac{1}{2}(3) + 5 = \frac{7}{2}$ $CE = CD \times \tan 26,57°$ $\therefore CE = \frac{7}{2} - 0 = \frac{7}{2}$ units $= 7 \times \tan 26,57° = \frac{7}{2}$	✓CA OD = 10 units ✓CA substituting D(10 ; 0) in $y = mx + 5$ **OR** substituting in gradient formula ✓CA value of m ✓CA substituting $x = 3$ in $y = -\frac{1}{2}x + 5$ **OR** ✓CA $CE = CD \times \tan 26,57°$ ✓CA answer	(5)
			[12]

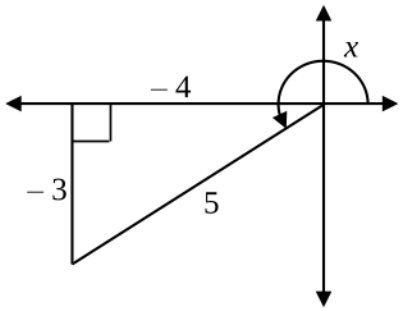
QUESTION 5			
5.1	$f : y = 3x^2$ $f^{-1} : x = 3y^2$ $y^2 = \frac{1}{3}x$ $y = \pm\sqrt{\frac{1}{3}x}$ $y = \sqrt{\frac{1}{3}x}$; $y \geq 0$	✓A swapping x and y ✓A $\pm\sqrt{\frac{1}{3}x}$ ✓A answer $y = \sqrt{\frac{1}{3}x}$	(3)
5.2		✓A ✓A shape of each graph ✓A coordinates of any two points on f ✓A coordinates of any two points on f^{-1}	(4)

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5.3	$3x^2 = \sqrt{\frac{1}{3}x}$ $\left(3x^2\right)^2 = \left(\sqrt{\frac{1}{3}x}\right)^2$ $9x^4 = \frac{1}{3}x$ $27x^4 - x = 0$ $x(27x^3 - 1) = 0$ $x(3x-1)(9x^2+3x+1) = 0$ **or** $x = 0$ or $27x^3 = 1$ $x = 0$ or $x = \frac{1}{3}$ $x = 0$ $x = \frac{1}{3}$ **OR** $x = \sqrt{\frac{1}{3}x}$ $x^2 = \left(\sqrt{\frac{1}{3}x}\right)^2$ $x^2 = \frac{1}{3}x$ $3x^2 = x$ $3x^2 - x = 0$ $x(3x-1) = 0$ $x = 0$ or $x = \frac{1}{3}$ **OR** $3x^2 = x$ $3x^2 - x = 0$ $x(3x-1) = 0$ $x = 0$ or $x = \frac{1}{3}$	✓CA equating ✓CA squaring both sides ✓A $x = 0$ ✓CA $x = \frac{1}{3}$ **OR** ✓CA equating ✓CA squaring both sides ✓A $x = 0$ ✓CA $x = \frac{1}{3}$ **OR** ✓A equating ✓A factors ✓A $x = 0$ ✓CA $x = \frac{1}{3}$	(4)
			[11]

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QUESTION 6

6.1.1	$r^2 = (-4)^2 + (-3)^2 = 25$ $\therefore r = 5$  $\therefore \sin x = \frac{-3}{5}$	 ✓ A sketch ✓ A $r = 5$ ✓ CA answer	(3)
6.1.2	$2 - \sin 2x$ $= 2 - 2 \sin x \cos x$ $= 2 - 2\left(\frac{-3}{5}\right)\left(\frac{-4}{5}\right)$ $= 2 - \frac{24}{25}$ $= \frac{26}{25}$	✓ A expansion ✓ CA substitution ✓ CA answer	(3)
6.1.3	$\cos^2(90° - x) - 1$ $= \sin^2 x - 1$ $= \left(\frac{-3}{5}\right)^2 - 1$ $= \frac{9}{25} - 1$ $= \frac{-16}{25}$	✓ A $\sin^2 x$ ✓ CA substitution ✓ CA answer	(3)
6.2	$\frac{-1 + \cos(180° - \theta) \cdot \sin(\theta - 90°)}{\cos(-\theta) \cdot \sin(90° + \theta) \cdot \tan^2(540° + \theta)}$ $= \frac{-1 + (-\cos\theta) \cdot -\cos\theta}{\cos\theta \cdot \cos\theta \cdot \tan^2(540° - 360° + \theta)}$ $= \frac{\cos^2\theta - 1}{\cos\theta \cdot \tan^2(180° + \theta)}$ $= \frac{-(1 - \cos^2\theta)}{\cos^2\theta \cdot \tan^2\theta}$ $= \frac{-\sin^2\theta}{\cos^2\theta \cdot \frac{\sin^2\theta}{\cos^2\theta}}$ $= -1$	In numerator: ✓ A $-\cos\theta$, ✓ A $-\cos\theta$ In denominator: ✓ A $\cos\theta$, ✓ A $\cos\theta$ ✓ A $\tan^2\theta$ ✓ CA $-\sin^2\theta$ ✓ CA answer after simplification	(7)
			[16]

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QUESTION 7

7.1.1	$\sin(A+B)$ $=\cos\left[90°-(A+B)\right]$ $=\cos(90°-A-B)$ $=\cos\left[(90°-A)-B\right]$ $=\cos(90°-A).\cos B+\sin(90°-A).\sin B$ $=\sin A.\cos B+\cos A.\sin B$	✓ A co-ratio ✓ A re-arrangement ✓ A expansion	(3)
7.1.2	$\sin(2x+50°)-\sin 15°\cos 48°=\sin 48°\cos 15°$ $\sin(2x+50°)=\sin 48°\cos 15°+\sin 15°\cos 48°$ $\sin(2x+50°)=\sin 63°$ $2x+50°=63°+k.360°$ OR $2x+50°=180°-63°+k.360°$ $2x=13°+k.360°$ $2x=67°+k.360°$ $x=6,5°+k.180°,\ k\in Z$ $x=33,5°+k.180°,k\in Z$	✓A using compound angle identity ✓ A both solutions ✓CA $x=6,5°+k.180°$ ✓CA $x=33,5°+k.180°$ $k\in Z$: penalty of 1 if not written at least once	(4)
7.2.1	$\frac{4\sin x\cos x}{2\sin^2 x-1}$ $=\frac{2(2\sin x\cos x)}{-(1-2\sin^2 x)}$ $=\frac{2\sin 2x}{-\cos 2x}$ $=-2\tan 2x$	✓ A $2\sin 2x$ ✓ A $-\cos x$ ✓ CA answer	(3)
7.2.2	$2\sin^2 x-1=0$ $\sin x=\pm\frac{1}{\sqrt{2}}$ $x=-45°$ or $x=45°$	✓ A $\pm\frac{1}{\sqrt{2}}$ ✓ CA $-45°$; CA ✓ $45°$	(3)
7.2.3	$\frac{4\sin 15°\cos 15°}{2\sin^2 15°-1}$ $=-2\tan 30°$ $=-2\left(\frac{1}{\sqrt{3}}\right)$ $=\frac{-2}{\sqrt{3}}$ or $\frac{-2\sqrt{3}}{3}$	✓ A $-2\tan 30°$ ✓ A answer	(2)
			[15]

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QUESTION 8

8.1	$m = -\frac{1}{2}$ $n = 30°$	✓ A $m = -\frac{1}{2}$ ✓ A $n = 30°$	(2)
8.2	amplitude of $f = 1$	✓ A answer	(1)
8.3	period of $h = 180°$	✓ A answer	(1)
8.4	$60° \leq x \leq 150°$	✓ ✓ A A answer	(2)
8.5	translation of $60°$ to the left; and reflection in the x-axis	✓ A translation of $60°$ to the left ✓ A reflection in the x-axis	(2)
			[8]

GRAND TOTAL: 100

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