education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

COMMON TEST

JUNE 2018

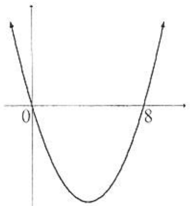
MARKING GUIDELINE

MARKS: 100

This marking guideline consists of 9 pages.

QUESTION 1

1.1.1	$(2x+1)(x-1)=0$ $x=-\frac{1}{2}$ or $x=1$	✓ $x=-\frac{1}{2}$ ✓ $x=1$ (2)
1.1.2	$2x^2+11=3x+21$ $2x^2-3x-10=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-3)\pm\sqrt{(-3)^2-4(2)(-10)}}{2(2)}$ $x=3{,}11$ or $x=-1{,}61$	✓ standard form ✓ substitution into quadratic formula ✓ answer ✓ answer (4)
1.1.3	$\sqrt{2x-1}+5=\frac{14}{\sqrt{2x-1}}$ Let $\sqrt{2x-1}=k$ $k+5=\frac{14}{k}$ $k^2+5k-14=0$ $(k+7)(k-2)=0$ $k=-7$ or $k=2$ $\sqrt{2x-1}=-7$ or $\sqrt{2x-1}=2$ No solution $\therefore 2x-1=4$ $\therefore x=2\frac{1}{2}$	✓ standard form ✓ factors ✓ both answers ✓ $\sqrt{2x-1}\neq-7$ ✓ answer (5)
1.2	$3x^2-5x(2x+1)+4(2x+1)^2=24$ $3x^2-10x^2-5x+4(4x^2+4x+1)=24$ $3x^2-10x^2-5x+16x^2+16x+4=24$ $9x^2+11x-20=0$ $(9x+20)(x-1)=0$ $x=-\frac{20}{9}$ or $x=1$ $y=2\left(-\frac{20}{9}\right)+1$ or $y=2(1)+1$ $y=-\frac{31}{9}$ or $y=3$	✓ substitution ✓ standard form ✓ factors ✓ both x-values ✓ both y-values (5)

1.3.1	$kx^2 + kx + 2 = 0$ $x = \dfrac{-k \pm \sqrt{k^2 - 4(k)(2)}}{2k}$ $x = \dfrac{-k \pm \sqrt{k^2 - 8k}}{2k}$	✓ substitution into quadratic formula ✓ answer	(2)
1.3.2	$k^2 - 8k < 0$ $k(k-8) < 0$  $0 < k < 8$	✓ $k^2 - 8k < 0$ ✓ factors ✓ answer	(3)
			[21]

QUESTION 2

2.1	$\dfrac{6^{\frac{1}{2}n} \times 12^{n+1} \times 27^{-\frac{1}{2}n}}{32^{\frac{1}{2}n}}$ $= \dfrac{(3\times2)^{\frac{1}{2}n} \times (3\times2^2)^{n+1} \times (3^3)^{-\frac{1}{2}n}}{(2^5)^{\frac{1}{2}n}}$ $= \dfrac{3^{\frac{1}{2}n} \times 2^{\frac{1}{2}n} \times 3^{n+1} \times 2^{2n+2} \times 3^{-\frac{3}{2}n}}{2^{\frac{5}{2}n}}$ $= 2^{\frac{1}{2}n+2n+2-\frac{5}{2}n}.3^{\frac{1}{2}n+n+1-\frac{3}{2}n}$ $= 3^1.2^2$ $= 12$	✓ writing as prime bases ✓ simplification using laws ✓ simplification using laws ✓ answer **NOTE: If a calculator is used, then NO marks will be awarded.**	(4)

2.2	$\dfrac{\sqrt{10^{2016}}}{\sqrt{10^{2018}} - \sqrt{10^{2014}}}$ $= \dfrac{10^{1008}}{10^{1009} - 10^{1007}}$ $= \dfrac{10^{1008}}{10^{1007}(10^2 - 1)}$ $= \dfrac{10}{10^2 - 1}$ $= \dfrac{10}{99}$	✓ determining square roots ✓ factorising denominator ✓ $\dfrac{10^{1008}}{10^{1007}} = 10$ ✓ answer	(4)
	OR	OR	
	$\dfrac{\sqrt{10^{2016}}}{\sqrt{10^{2018}} - \sqrt{10^{2014}}}$ $= \dfrac{\sqrt{10^{2014}}.\sqrt{10^2}}{\sqrt{10^{2014}}(\sqrt{10^4} - 1)}$ $= \dfrac{10}{10^2 - 1}$ $= \dfrac{10}{99}$ or 0,10	✓ writing numerator as $\sqrt{10^{2014}}.\sqrt{10^2}$ ✓ factorizing denominator ✓ simplification ✓ answer	(4)
			[8]

QUESTION 3

The length of the side of the clock is x $\therefore$ the length of each corner cut out is $\dfrac{16-x}{2}$ $\left(\dfrac{16-x}{2}\right)^2 + \left(\dfrac{16-x}{2}\right)^2 = x^2$ [Theorem of Pythagoras] $\dfrac{256 - 32x + x^2}{4} + \dfrac{256 - 32x + x^2}{4} = x^2$ $512 - 64x + 2x^2 = 4x^2$ $2x^2 + 64x - 512 = 0$ $x^2 + 32x - 256 = 0$ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \dfrac{-32 \pm \sqrt{(32)^2 - 4(1)(-256)}}{2(1)}$ $x = 6{,}63 \because x \neq -38{,}63$ the length of the side of the clock is 6,63 cm	✓ $\dfrac{16-x}{2}$ ✓ equation ✓ simplification ✓ standard form ✓ substitution into quadratic formula ✓ both values of x ✓ answer	[7]

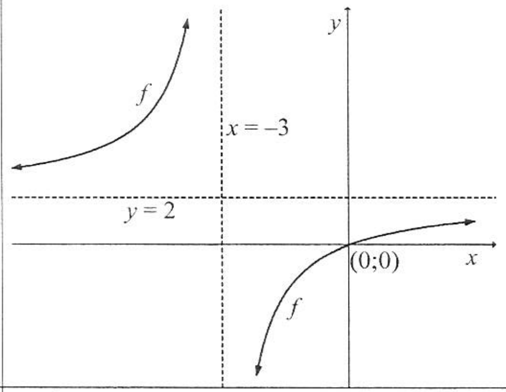
QUESTION 4

4.1.1	0 ; −9 ; −16 ; −21 First differences: −9 ; −7 ; −5 Second differences: 2 ; 2 $2a = 2$ $a = 1$ $3(1) + b = -9$ $b = -12$ $1 - 12 + c = 0$ $c = 11$ $\therefore T_n = n^2 - 12n + 11$	✓ calculate a ✓ calculate b ✓ calculate c ✓ answer (4)
4.1.2	$\therefore T_{30} = (30)^2 - 12(30) + 11$ $= 551$	✓ substitution of 30 for n into T_n ✓ answer (2)
4.1.3	$200 = n^2 - 12n + 11$ $n^2 - 12n - 189 = 0$ $(n - 21)(n + 9) = 0$ $n \neq -9 \ \therefore n = 21$	✓ equating T_n to 200 ✓ standard form ✓ factors or quadratic formula ✓answer (4)

4.2.1(a)	Number of grey squares: 1 ; 4 ; 9; … = $1^2; 2^2; 3^2$ … Number of grey squares in Figure 4 = $4^2 = 16$	✓ 16 (1)
4.2.1(b)	Number of white squares: 4 ; 8 ; 12; … = 1(4); 2(4); 3(4); …. Number of white squares in Figure 4 = 4(4) = 16	✓ 16 (1)
4.2.1(c)	Number of dots: 12 ; 21 ; 32 ; … = $2^2 + 4(2)$; $3^2 + 4(3)$; $4^2 + 4(4)$; …. Number of dots in Figure 4 = $5^2 + 5(4) = 25 + 20 = 45$ OR Number of dots: 12 ; 21 ; 32 ; 9 11 Number of dots in Figure 4 = 32+13 = 45	✓45 (1) OR ✓45 (1)

4.2.2(a)	n^2	✓ answer (1)
4.2.2(b)	$4n$	✓ answer (1)
4.2.2(c)	$(n+1)^2 + 4(n+1)$ **OR** $2a = 2$ $a = 1$ $3(1) + b = 9$ $b = 6$ $1 + 6 + c = 12$ $c = 5$ $\therefore n^2 + 6n + 5$ **OR** $(n+3)^2 - 4$	✓ $(n+1)^2$ ✓ $+4(n+1)$ (2) **OR** ✓ calculating a, b and c ✓ answer (2) **OR** ✓ ✓ answer (2)
4.2.3	$n^2 + 6n + 5 = 320$ $n^2 + 6n - 315 = 0$ $(n+21)(n-15) = 0$ $n \neq -21 \ \therefore n = 15$ number of grey squares = 15^2 $= 225$	✓ equating answer of 4.2.2(c) to 320 ✓ standard form ✓ factors or quadratic formula ✓ value of n ✓ answer (5)
		[22]

QUESTION 5

5.1.1	For y-intercept, substitute $x = 0$: $y = \frac{-6}{0+3} + 2$ $= 0$ OR For x-intercept, substitute $y = 0$: $0 = \frac{-6}{x+3} + 2$ $\frac{6}{x+3} = 2$ $x + 3 = 3$ $x = 0$ The graph therefore goes through the origin: $(0 ; 0)$ 	✓ substitution ✓ answer ✓ horizontal asymptote: $y = 2$ ✓ vertical asymptote: $x = -3$ ✓ passing through the origin ✓ shape (6)
5.1.2	$m = 1$	✓ answer (1)
5.2.1	$y > 0$ **OR** $y \in (0 ; \infty)$	✓ answer **OR** ✓ answer (1)
5.2.2	$\frac{9}{4} = a^2$ $a = \frac{3}{2}$	✓ substitution ✓ answer (2)
5.2.3	$y = \left(\frac{3}{2}\right)^{-x}$ $\therefore y = \left(\frac{2}{3}\right)^{x}$	✓ change sign of x ✓ answer (2)
5.2.4	$B'\left(-2 ; 2\frac{1}{4}\right)$ $C(0 ; 1)$ Average gradient $= \frac{2\frac{1}{4} - 1}{-2 - 0}$ $= -\frac{5}{8}$	✓ coordinates of B' ✓ coordinates of C ✓ substitution into average gradient formula ✓ answer (4)

5.3.1	$y = a(x + p)^2 + q$ $y = a(x - 2)^2 - 3$ $-5 = a(0 - 2)^2 - 3$ $-2 = 4a$ $a = -\frac{1}{2}$ $y = -\frac{1}{2}(x - 2)^2 - 3$ $y = -\frac{1}{2}(x^2 - 4x + 4) - 3$ $y = -\frac{1}{2}x^2 + 2x - 5$	✓ substitution of turning point, A ✓ substitution of point B ✓ value of a ✓ substitution of a ✓ simplification (5)
5.3.2	$k < -3$	✓✓ answer (2)
5.3.3	$(2 ; 2)$	✓ x–coordinate ✓ y–coordinate (2)
		[25]

QUESTION 6

6.1	$A\left(0;-4\frac{1}{2}\right)$ $\frac{3}{2}x^2+3x-\frac{9}{2}=0$ $x^2+2x-3=0$ $(x-1)(x+3)=0$ $x=1$ or $x=-3$ B(−3 ; 0) and C(1 ; 0)	✓ coordinates of A ✓ let $y=0$ ✓ factors ✓ coordinates of B ✓ coordinates of C (5)
6.2	Axis of symmetry: $x=\frac{-3+1}{2}$ OR $x=\frac{-3}{2\left(\frac{3}{2}\right)}$ $\therefore x=-1$ Minimum value: $y=\frac{3}{2}(-1)^2+3(-1)-\frac{9}{2}$ $y=-6$ $\therefore D(-1;-6)$	✓ method of determining the axis of symmetry ✓ x–coordinate ✓ y–coordinate (3)
6.3	$x\le-3$ or $x\ge0$	✓✓ answer (2)
6.4	gradient of AB: $=\frac{0-(-4,5)}{-3-0}$ $=-\frac{3}{2}$ $y=-\frac{3}{2}x-\frac{9}{2}$	✓ substitution in gradient formula ✓ value of gradient ✓ equation of g (3)
6.5	$-6=-\frac{3}{2}x-\frac{9}{2}$ $x=1$ at point E. $\therefore DE=1-(-1)$ DE = 2 units	✓✓ equating y_E to y_D ✓ value of x ✓ answer (4)
		[17]

TOTAL: 100