GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

NOVEMBER 2022

GRADE 11

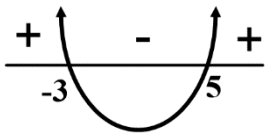
MARKING GUIDELINES

MATHEMATICS (PAPER 1)

19 pages

QUESTION 1

1.1	1.1.1	When $x = 2$ and when $x = 3$ $\sqrt{3-x}$ $\sqrt{3-3}$ $\sqrt{3-2}$ $\sqrt{0}$ *and* $\sqrt{1}$ $= 0$ $= 1$ $\therefore x = 2$ *or* $x = 3$	✓ ✓ answers	(2)
	1.1.2	$\sqrt{3-x} = 2x - 3$ $\therefore 3 - x \geq 0$ *and* $2x - 3 \geq 0$ $\therefore -x \geq -3$ *and* $2x \geq 3$ $\therefore x \leq 3$ *and* $x \geq \frac{3}{2}$ $\therefore \frac{3}{2} \leq x \leq 3$ **NOTE:** Answer can be written as separate inequalities. **OR** **NOTE:** If the candidates solve the equation, the answers are: $x = \frac{3}{4}$ *or* $x = 2$, the answer of $x = \frac{3}{4}$ must be rejected to obtain $\frac{3}{3}$, but if not rejected, award $\frac{2}{3}$.	✓ setting up correct inequalities ✓✓ answers	(3)
1.2		$(3a - 8)(2b + 7) = 0$ $\therefore 3a - 8 = 0$ *or* $2b + 7 = 0$ $\therefore a = \frac{8}{3}$ $\therefore b = -\frac{7}{2}$	✓ value of a ✓ value of b	(2)

1.3	1.3.1	$4x^2 - 20x + 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-20) \pm \sqrt{(-20)^2 - 4(4)(1)}}{2(4)}$ $x = \frac{20 \pm \sqrt{384}}{8}$ $\therefore x = 4{,}95 \quad or \quad x = 0{,}05$ **NOTE:** Penalise one mark for incorrect rounding-off in this question ONLY.	✓ substitution ✓✓ answers	(3)
	1.3.2	$(x + 1)(x - 3) > 12$ $x^2 - 2x - 3 > 12$ $x^2 - 2x - 15 > 0$ $(x - 5)(x + 3) > 0$  $\therefore x > 5 \quad or \quad x < -3$	✓ standard form ✓ factors ✓✓ answers	(4)
	1.3.3	$x - \sqrt{5 + x} = 7$ $x - 7 = \sqrt{5 + x}$ $(x - 7)^2 = (\sqrt{5 + x})^2$ $x^2 - 14x + 49 = 5 + x$ $x^2 - 15x + 44 = 0$ $(x - 4)(x - 11) = 11$ $x = 11 \quad or \quad x \neq 4$	✓ squaring both sides ✓ simplification ✓ standard form ✓ factors ✓ answers with rejection	(5)

1.4	1.4.1	$x = 3$ *and* $y = a$ $\therefore x - y = 1$ $\therefore 3 - a = 1$ $\therefore a = 2$ *but* $x^2 - 3xy + by^2 = -5$ $\therefore 3^2 - 3(3)(2) + b\,(2)^2 = -5$ $\therefore 9 - 18 + 4b = -5$ $\therefore 4b = 4$ $\therefore b = 1$	✓ value of a ✓ substitute for x and y ✓ simplification ✓ value of b	(4)
	1.4.2	$x - y = 1$ $\therefore x = y + 1$……(1) $x^2 - 3xy + y^2 = -5$……(2) $\therefore (y + 1)^2 - 3y(y + 1) + y^2 = -5$ $\therefore y^2 + 2y + 1 - 3y^2 - 3y + y^2 = -5$ $\therefore -y^2 - y + 6 = 0$ $\therefore y^2 + y - 6 = 0$ $\therefore (y + 3)(y - 2) = 0$ $\therefore y = -3$ *or* $y = 2$ $\therefore x = -2$ *or* $x = 3$ The other solution: $(-2;-3)$ **NOTE:** Candidates do not have to write the answer in coordinate form.	✓ x as subject ✓ substitute into (2) ✓ standard form ✓ factors ✓ y-values ✓ x-values	(6)

1.5	1.5.1	$(p + 1)x^2 + 2px + (p + 2) = 0$ $\Delta = b^2 - 4ac$ $\Delta = (2p)^2 - 4(p + 1)(p + 2)$ $\Delta = 4p^2 - 4p^2 - 12p - 8$ $\Delta = -12p - 8$ For equal roots, $\Delta = 0$ $-12p - 8 = 0$ $\therefore p = -\frac{8}{12}$ $\therefore p = -\frac{2}{3}$	✓ substitution for Δ ✓ expression for Δ ✓ condition for Δ ✓ answer	(4)
	1.5.2	$\Delta > 0$ $\therefore -12p - 8 > 0$ $\therefore p < -\frac{2}{3}$	✓ condition of Δ ✓ answer	(2)
				[35]

QUESTION 2

2.1	2.1.1	$(\frac{1}{3^{n-1}}.\frac{1}{3^{n+1}})^{\frac{1}{n}}$ $= (3^{-n+1}.3^{-n-1})^{\frac{1}{n}}$ $= (3^{-2n})^{\frac{1}{n}}$ $= 3^{-2}$ $= \frac{1}{9}$ **NOTE:** Any other valid method.	✓ simplification ✓ simplification ✓ answer	(3)
	2.1.2	$-\sqrt[3]{27^2} - \frac{2}{8^{-\frac{2}{3}}} + \frac{\sqrt[5]{2}}{4^{-\frac{2}{5}}}$ $= [(3^3)^2]^{\frac{1}{3}} - \frac{2}{(2^3)^{-\frac{2}{3}}} + \frac{2^{\frac{1}{5}}}{(2^2)^{-\frac{2}{5}}}$ $= 3^2 - \frac{2}{2^{-2}} + \frac{2^{\frac{1}{5}}}{2^{-\frac{4}{5}}}$ $= 9 - 2^3 + 2^1$ $= 3$ **NOTE:** Any other valid method.	✓ simplification ✓ simplification ✓ simplification ✓ answer	(4)

2.2	$3^{2-x} + 8 = 3^x$ $3^2.3^{-x} + 8 = 3^x$ $\frac{9}{3^x} + 8 = 3^x$ $9 + 8.3^x = 3^{2x}$ $3^{2x} + 8.3^x - 9 = 0$ $(3^x - 9)(3^x + 1) = 0$ $3^x = 9$ *or* $3^x = -1$ $3^x = 3^2$ *or* *NA* $\therefore x = 2$ **NOTE:** Any other valid method.	✓ simplification ✓ standard form ✓ factors ✓ answer with rejection	(4)
			[11]

QUESTION 3

3.1	1 ; 2 ; 5 ; 10 +1 +3 +5 +2 +2 $2a = 2$ $3a + b = 1$ $a + b + c = 1$ $a = 1$ $3(1) + b = 1$ $1 - 2 + c = 1$ $b = -2$ $c = 2$ $\therefore Tn = n^2 - 2n + 2$ **NOTE:** No penalty if not written as an equation.	2^{nd} difference ✓ value of a ✓ value of b ✓ value of c	(4)
3.2	$T_{50} = 50^2 - 2(50) + 2$ $T_{50} = 2402$	✓ substitution ✓ answer	(2)
3.3	ROW 11	✓✓ answer	(2)

3.4	1 ; 3 ; 5 ; 7 +2 +2 +2 $Tn = 2n - 1$ $241 = 2n - 1$ $n = 121$	✓ correct equation ✓ $Tn = 241$ ✓ answer	(3)
			[11]

QUESTION 4

4.1	4 ; 9 ; x ; 37… 5 ; $x-9$; $37-x$ $x-9-5$; $37-x-(x-9)$ $x-14$; $46-2x$ $x - 14 = 46 - 2x$ $\therefore 3x = 60$ $\therefore x = 20$	✓ 1st differences ✓ 2nd differences ✓ equating ✓ answer	(4)
4.2	5 ; 11 ; 17 ;… (first differences) $T_n = 6n - 1$ $599 = 6n - 1$ $600 = 6n$ $n = 100$ $\therefore$ Between 100^{th} and 101^{th} terms	✓ correct equation ✓ equating ✓ value of n ✓ conclusion	(4)

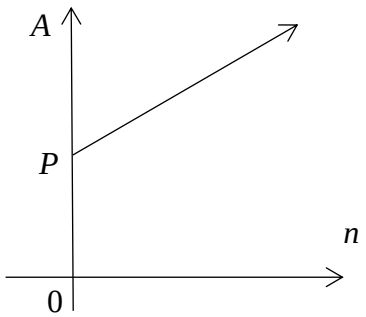
4.3	4.3.1	4 ; 9 ; 20 ; 37 5 11 17 6 6 $2a = 6$ $a = 3$ $\therefore Tn = 3n^2 + bn + c$ Since the a-value is positive, T_n has a MINIMUM value.	✓ 2^{nd} difference ✓ value of a ✓ conclusion	(3)
	4.3.2	$y = 3n^2 - 4n + 5$ $\therefore x = \frac{-(-4)}{2(3)}$ $\therefore x = \frac{4}{6}$ $\therefore x = \frac{2}{3}$ $\therefore f\left(\frac{2}{3}\right) = \frac{11}{3}$ $\therefore$ range: $y \geq \frac{11}{3}$ **OR** $y \in [\frac{11}{3}; \infty)$ **NOTE:** Correct brackets must be used to obtain the answer mark in option 2. This is a **theoretical** solution as it is understood that a number pattern is composed of terms which are indicated as natural numbers.	✓ value of x ✓ value of $f\left(\frac{2}{3}\right)$ ✓ answer	(3)

4.4	For n to be common to both patterns: $6n - 1 = 3n^2 - 4n + 5$ $\therefore 0 = 3n^2 - 10n + 6$ $\therefore n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $\therefore n = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(3)(6)}}{2(3)}$ $\therefore n = \frac{5 \pm \sqrt{7}}{3}$ $\therefore$ NO, n is not a Natural Number.	 ✓ equating ✓ simplification ✓ conclusion	 (3)
			[17]

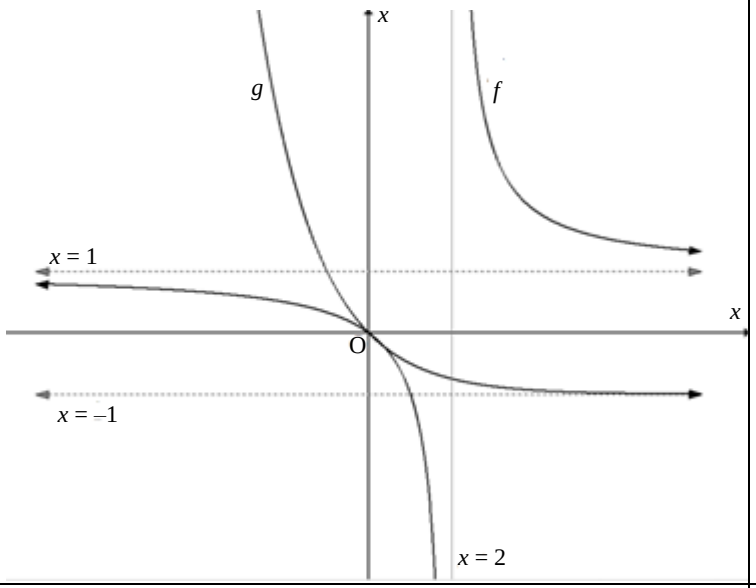
QUESTION 5

5.1	$1 + i_{effective} = (1 + i_{nominal})^n$ $\therefore i_{nominal} = \frac{0{,}135}{12}$ $\therefore 1 + i_e = (1 + \frac{0{,}135}{12})^{12}$ $\therefore 1 + i_e = 1{,}14$ $\therefore i_e = 0{,}14$ $\therefore i_e = 14\%$	 ✓ $i_{nominal}$ ✓ correct substitution into correct formula ✓ simplification i_e ✓ answer	 (4)

5.2	$A = P(1 + in)$ $\therefore\ 7\,500 = 6\,800(1 + 0{,}075n)$ $\therefore\ \frac{7\,500}{6\,800} - 1 = 0{,}075n$ $\therefore 0{,}075n = 0{,}10$ $\therefore\ n = 1{,}333\ yrs$ $\therefore\ n = 1{,}333(12)$ $\therefore\ n = 15{,}996$ $\therefore\ n \approx 16\ mnths$ **NOTE:** The answer mark is for 16 months.		✓ substitution into correct formula ✓ value of n ✓ answer	(3)
5.3	Compounded semiannually for 6 years. $\therefore\ n = 12$ $\therefore\ i = \frac{0{,}05}{2} = 0{,}025$ $A = P(1 + i)^n$ $A = 5\,000(1 + 0{,}025)^{12}$ $\therefore\ A = \text{R}6\,724{,}44$		✓ value of n and i ✓ substitution into correct formula ✓ answer	(3)
5.4	5.4.1	$A = P(1 + in)$ $A = P + Pin$ $\therefore$ linear function	✓ answer	(1)

	5.4.2	$m = Pi$ $P > 0$ $i > 0$ $\therefore m > 0$  	✓ $m > 0$ ✓ shape ($c > 0$)	(2)
	5.4.3	$n = 0$: $A = P + Pi(0)$ $\therefore A = P$ $n = 1$: $A = P + Pi(1)$ $A = P + Pi$ $\therefore$ an INCREASE in Pi **NOTE:** Answer only, full marks.	✓ answer	(1)
				[14]

QUESTION 6

6.1	$x = 2$ $y = 1$	✓ answer ✓ answer	(2)
6.2	$y = -1$	✓ answer	(1)
6.3		✓ shape of f ✓ intercepts of f ✓ shape of g ✓ intercept of g	(4)
6.4	$x \in R; x \neq 2$ *or* $x \in (-\infty;2)$ *or* $(2; \infty)$ **NOTE:** Must state both conditions in option 1.	✓ answer	(1)
6.5	$y > -1$ *or* $y \in (-1;\infty)$	✓ answer	(1)
6.6	Point of intersection of asymptotes: (2;1) $y - y_1 = m(x - x_1)$ $y - 1 = -1(x - 2)$ $y = -x + 3$	✓ substitute m and pt (2 ; –1) ✓ answer	(2)
6.7	2 units to the right and 1 unit upwards	✓ units right ✓ units up	(2)

6.8	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $d = \sqrt{(2-0)^2 + (1-0)^2} \cdots\cdots (0;0)(2;1)$ $d = \sqrt{5}$ $d = 2{,}24$ **NOTE:** Answer only, full marks. No penalty for rounding-off incorrectly.	✓ correct substitution ✓ answer	(2)
6.9	(3 ; 0)	✓ *x*-value ✓ *y*-value	(2)
6.10	$x \in (-\infty;2)$ *or* $x < 2$	✓ answer	(1)
			[18]

QUESTION 7

7.1	$y = a(x - x_1)(x - x_2)$ $4 = a(0-1)(0-3)$ $4 = 3a$ $\therefore a = \frac{4}{3}$ $y = \frac{4}{3}(x-1)(x-3)$ $y = \frac{4}{3}(x^2 - 4x + 3)$ $y = \frac{4}{3}x^2 - \frac{16}{3}x + 4$	✓ substitute roots and point (0 ; 4) ✓ value for *a* ✓ answer	(3)

7.2	$f(x)=\frac{4}{3}x^2-\frac{16}{3}x+4$ $x=\frac{-b}{2a}$ $x=\frac{-(-\frac{16}{3})}{2(\frac{4}{3})}$ $\therefore\ x=2$ $\therefore\ f(2)=\frac{4}{3}(2)^2-\frac{16}{3}(2)+4$ $\therefore\ f(2)=-\frac{4}{3}$ $\therefore$ D$(2\ ;\ -\frac{4}{3})$ **NOTE:** Answer does not have to be in coordinate form.	✓ substitution into correct formula ✓ x-value ✓ y-value	(3)
7.3	$m_g=\frac{0-4}{-8-0}\cdots\cdots(0;4)(-8;0)$ $\therefore\ m_g=\frac{1}{2}$ $\therefore\ m_p=-2$ $\therefore\ -\frac{4}{3}=-2(2)+c\cdots\cdots D(2;-\frac{4}{3})$ $\therefore\ c=4-\frac{4}{3}$ $\therefore\ c=\frac{8}{3}$ $\therefore\ p(x)=-2x+\frac{8}{3}$ **NOTE:** Answer does not have to be an equation.	✓ substitute correctly into gradient formula ✓ value of m_g ✓ value of m_p ✓ substitute m and point D ✓ value of c	(5)

7.4	$m = \tan\theta$ $\frac{1}{2} = \tan\theta$ $\therefore\ \theta = 26{,}57°$		✓ $\tan\theta = \frac{1}{2}$ ✓ answer	(2)
7.5	$\frac{4}{3}x^2 - \frac{16}{3}x + 4 = \frac{1}{2}x + 4$ $\frac{4}{3}x^2 - \frac{35}{6}x = 0$ $x\left(\frac{4}{3}x - \frac{35}{6}\right) = 0$ $x = 0$ of $x = \frac{35}{8}$ $y = \frac{1}{2}\left(\frac{35}{8}\right) + 4$ $y = \frac{99}{16}$ $K\left(\frac{35}{8};\frac{99}{16}\right)$ **NOTE:** Answer does not need to be in coordinate form.		✓ equating ✓ factors ✓ x-answers ✓ y-answer from correct selection of x-value	(4)
7.6	7.6.1	$1 < x < 3$ **NOTE:** Can be written as separate inequalities.	✓ answer	(1)
	7.6.2	$x \in (-8\ ;\ 1]$ *or* $[3\ ;\ \infty)$ **NOTE:** Penalise 1 mark if answer is not with correct brackets.	✓ answer ✓ answer	(2)

7.7	TP$(2 ; -\frac{4}{3})$ *from* *Q*. 7.2 $\therefore f(x) = \frac{4}{3}(x-2)^2 - \frac{4}{3}$ $\therefore h(x) = \frac{4}{3}(x-4)^2 - \frac{13}{3}$		✓ equation of f ✓ equation of h	(2)
7.8	7.8.1	$j(x) = ax - 8$ $\therefore 0 = -4a - 8 \ldots\ldots pt(-4 ; 0)$ $\therefore 4a = -8$ $\therefore a = -2$	✓ substitution ✓ answer	(2)
	7.8.2	The graph of g to j is a 90° anticlockwise rotation about the origin. **NOTE:** Accept, graphs are perpendicular and if g is shifted anti-clockwise by 90°, j is obtained.	✓ answer	(1)
				[25]

QUESTION 8				
8.1	Total = 13 + 7 + 24 + 3 Total = 47		✓ answer	(1)
8.2	8.2.1	P(M) = $\frac{13+7}{47}$ P(M) = $\frac{20}{47}$ …*or*…0,43	✓ answer	(1)
	8.2.2	P(M and S) = $\frac{7}{47}$ *or* 0,15	✓ answer	(1)
	8.2.3	P(not M or S) = $\frac{3}{47}$ *or* 0,06	✓ answer	(1)

	8.2.4	P(M or S) = $\frac{13+7+24}{47}$ P(M or S) = $\frac{44}{47}$ or 0,94 **OR** P(M or S) = P(M) + P(S) – P(M and S) = $\frac{20}{47} + \frac{31}{47} - \frac{7}{47}$ P(M or S) = $\frac{44}{47}$ *or* 0,94	✓ method ✓ answer ✓ method ✓ answer	(2)
	8.2.5	P(M or only S) = $\frac{13+24}{47}$ P(M or only S) = $\frac{37}{47}$ *or* 0,79 **NOTE:** Answer only, full marks.	✓ method ✓ answer	(2)
8.3	8.3.1	P(A or B) = P(A) + P(B) – P(A and B) = 0,95 + 0,98 – 0,94 P(A or B) = 0,99 **NOTE:** Answer only, full marks.	✓ correct substitution ✓ answer	(2)
	8.3.2	P(Not Detected) = 1 – 0,99 P(Not Detected) = 0,01 **NOTE:** Answer only, full marks.	✓ answer	(1)
				[11]

QUESTION 9

9.1	9.1.1	NO. The survey was done on ONE day of the month and only in the morning. **NOTE:** Answer must be NO.	✓ NO ✓ reasonable motivation	(2)
	9.1.2	The survey should be done: • At different TIMES of the day. • On different DAYS of the month, especially at the end of the month when most people do shopping. **NOTE:** Any other valid reason.	✓ answer	(1)
9.2		P(black) = $\frac{26}{52} \times \frac{25}{51} \times \frac{24}{50}$ $\therefore$ P(black) = $\frac{2}{17}$ *or* 0,118 P(red) = $\frac{26}{52} \times \frac{25}{51} \times \frac{24}{50}$ $\therefore$ P(red) = $\frac{2}{17}$ *or* 0,118 $\therefore$ P(3 black or 3 red) = 0,118 + 0,118 $\therefore$ P(3 black or 3 red) = 0,236 *or* $\frac{59}{250}$	✓ $\frac{26}{52} \times \frac{25}{51} \times \frac{24}{50}$ ✓ answer P(black) ✓ answer P(red) ✓ method (+) ✓ answer P(3 black or 3 red)	(5)
				[8]
			TOTAL:	**150**