



**GAUTENG PROVINCE**  
EDUCATION  
REPUBLIC OF SOUTH AFRICA

# **PREPARATORY EXAMINATION**

## **2017**

### **MARKING GUIDELINES**

**MATHEMATICS (FIRST PAPER) (10611)**

**14 pages**

**GAUTENG DEPARTMENT OF EDUCATION  
PREPARATORY EXAMINATION**

**MATHEMATICS  
(First Paper)**

**MEMORANDUM**

<b>QUESTION 1</b>		
1.1		
1.1.1	$x(x-1) = 12$ $x^2 - x = 12$ $x^2 - x - 12 = 0$ $(x-4)(x+3) = 0$ $x = 4$ <b>OR</b> $x = -3$	✓ standard form ✓ both factors ✓ both answers (3)
1.1.2	$2x^2 + 3 = 8x$ $2x^2 - 8x + 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{8 \pm \sqrt{(-8)^2 - 4(2)(3)}}{2(2)}$ $= \frac{8 \pm \sqrt{64 - 24}}{4}$ $= \frac{8 \pm \sqrt{40}}{4}$ $x = 3,58$ <b>OR</b> $x = 0,42$	✓ standard form  ✓ substitution into correct formulae  ✓✓ each $x$ answer (4)
1.1.3	$(2x+3)(3-x) > 4$ $6x - 2x^2 + 9 - 3x - 4 > 0$ $-2x^2 + 3x + 5 > 0$ $2x^2 - 3x - 5 < 0$ $(2x-5)(x+1) < 0$ $-1 < x < \frac{5}{2}$	✓ simplification  ✓ standard form $2x^2 - 3x - 5 < 0$ ✓ factors ✓ critical values ✓ inequalities (5)
1.1.4	$2^x - 5 \cdot 2^{x+1} = -144$ $2^x(1 - 5 \cdot 2) = -144$ $2^x(-9) = -144$ $2^x = 16$ $2^x = 2^4$ $x = 4$	✓ common factor ✓ simplification $2^x = 2^4$ ✓ answer (3)



<p>2.3</p>	$T_8 = 33 = a + 7d \quad (1)$ $T_{11} = 45 = a + 10d \quad (2)$ <p>From equation (2):</p> $a + 10d = 45 \quad (2)$ $a + 7d = 33 \quad (1)$ $a = 45 - 10d \quad (3) \quad \text{OR} \quad (2) - (1):$ $3d = 12$ $d = 4$ <p>Substitute (3) into (1):</p> $33 = 45 - 10d + 7d$ $-12 = -3d$ $d = 4$ <p>Substitute into (2)</p> $a = 45 - 10(4)$ $a = 5$ $T_{15} = 5 + 14(4)$ $T_{15} = 61$ <p><b>OR</b></p> $T_8 + 3d = T_{11}$ $33 + 3d = 45$ $3d = 12$ $d = 4$ $T_{15} = T_{11} + 4d$ $T_{15} = 45 + 4(4)$ $= 61$	<p>✓equation 1 ✓equation 2</p> <p>✓value of <math>d</math></p> <p>✓value of <math>a</math></p> <p>✓<math>T_{15} = 61</math></p> <p>✓<math>T_8 + 3d = T_{11}</math> ✓substitution</p> <p>✓value of <math>d</math> ✓<math>T_{15} = T_{11} + 4d</math></p> <p>✓answer</p> <p>(5)</p>
<p>2.4</p>	$2a = -4$ $a = -2$ $3a + b = 0$ $3(-2) + b = 0$ $b = 6$ $a + b + c = 6$ $-2 + 6 + c = 6$ $c = 2$ $T_n = -2n^2 + 6n + 2$	<p>✓second difference ✓value of <math>a</math></p> <p>✓value of <math>b</math></p> <p>✓value of <math>c</math></p> <p>(4)</p>

2.5 2.5.1	$3; \frac{3}{2}; \frac{3}{4}; \dots$ $S_{\infty} = \frac{a}{1-r}$ $S_{\infty} = \frac{3}{1-\frac{1}{2}}$ $= 6$	<p>✓ substitute into the correct formula</p> <p>✓ answer</p> <p>(2)</p>
2.5.2	$S_n = \frac{a(1-r^n)}{1-r}$ $S_n = \frac{3\left(1-\left(\frac{1}{2}\right)^n\right)}{1-\frac{1}{2}}$ $= 6\left(1-\left(\frac{1}{2}\right)^n\right)$	<p>✓ substitute into the correct formula</p> <p>✓ answer</p> <p>(2)</p>
2.5.3	$A - B < \frac{1}{36}$ $6 - 6\left(1 - \left(\frac{1}{2}\right)^n\right) < \frac{1}{36}$ $6\left(1 - 1 + \left(\frac{1}{2}\right)^n\right) < \frac{1}{36}$ $1 - 1 + \left(\frac{1}{2}\right)^n < \frac{1}{216}$ $\left(\frac{1}{2}\right)^n < \frac{1}{216}$ $n > \log_{\frac{1}{2}} \frac{1}{216}$ $n > 7,75$ $\therefore n = 8; 9; \dots$	<p>✓ factorisation</p> <p>✓ <math>\frac{1}{216}</math></p> <p>✓ <math>\left(\frac{1}{2}\right)^n &lt; \frac{1}{216}</math></p> <p>✓ <math>\log_{\frac{1}{2}} \frac{1}{216}</math></p> <p>✓ answer</p> <p>(5)</p>
		[25]

QUESTION 3		
3.1	$(1 + i_{eff}) = \left(1 + \frac{i_{nom}}{m}\right)^m$ $(1 + i_{eff}) = \left(1 + \frac{0,06}{4}\right)^4$ $i_{eff} = 1,06 - 1$ $i_{eff} = 6,14\%$	<p>✓ correct formula</p> <p>✓ correct substitution</p> <p>✓ answer</p> <p>(3)</p>
3.2	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{2000[1 - (1 + 0,02)^{-24}]}{0,02}$ $= R37\ 827,85$ <p>The gym borrowed R 37 827,85.</p>	<p>✓ substitution of <math>x</math> into correct formula</p> <p>✓ <math>n = 24</math></p> <p>✓ <math>i = 0,02</math></p> <p>✓ answer</p> <p>(4)</p>
3.3	$F = \frac{x[(1 + i)^n - 1]}{i}$ $200000 = \frac{x\left[\left(1 + \frac{0,0625}{12}\right)^{57} - 1\right]}{\frac{0,0625}{12}}$ $x = \frac{200000 \times \frac{0,0625}{12}}{\left[\left(1 + \frac{0,0625}{12}\right)^{57} - 1\right]}$ $x = 3022,73$ <p>∴ The monthly payments are R 3 022,73 per month.</p>	<p>✓ formula</p> <p>✓ value of <math>F</math></p> <p>✓ <math>n = 57</math></p> <p>✓ <math>i = \frac{0,0625}{12}</math></p> <p>✓ making <math>x</math> the subject</p> <p>✓ answer</p> <p>(6)</p>
		[13]



4.3	$g(x) = 4 \cdot 2^{x-2+1} - 2$ $g(x) = 4 \cdot 2^{x-1} - 2$  <b>OR</b> $g(x) = 2 \cdot 2^x - 2$  <b>OR</b> $g(x) = 2^{x+1} - 2$	✓ answer  ✓ answer  ✓ answer	(1)
			[11]
	<b>QUESTION 5</b>		
5.1		✓3	
5.1.1	(3; 4)	✓4	(2)
5.1.2	$y \geq -4$  <b>OR</b> $y \in [-4; \infty)$	✓ critical values ✓ inequality  ✓ critical values ✓ correct brackets	(2)
5.1.3	(2; 3) (5; 0) $m = \frac{0-3}{5-2}$ $m = -1$	✓ substitute with correct coordinates ✓ answer	(2)
5.1.4	$y = -(-1) + 5$ $y = 6$ $KM = 6$  $y = -(-1-3)^2 + 4$ $y = -12$ $LM = 12$  $KL = 12 + 6$ $= 18$	✓ $KM = 6$ <b>OR</b> $y = 6$  ✓ $LM = 12$ <b>OR</b> $y = -12$  ✓ $KL = 18$	(3)
5.1.5	$x \in (2; 5)$  <b>OR</b> $2 < x < 5$	✓ critical values ✓ correct brackets  ✓ critical values ✓ correct inequality	(2)



5.2 5.2.1	$y = \left(\frac{4}{3}\right)^x$ $x = \left(\frac{4}{3}\right)^y$ $y = \log_{\frac{4}{3}} x$ $g(x) = \log_{\frac{4}{3}} x$	✓ interchange $x$ and $y$  ✓ $g(x) = \log_{\frac{4}{3}} x$  (2)
5.2.2	$h(x) = \left(\frac{4}{3}\right)^{-x}$ $= \left(\frac{3}{4}\right)^x$	✓ $-x$  ✓ answer  (2)
5.2.3 a)	$x = 0$	✓ answer  (1)
b)	$0 < x \leq 1$  <b>OR</b>  $x \in (0;1]$	✓ critical values ✓ inequalities  ✓ critical values ✓ correct brackets  (2)
		<b>[18]</b>

QUESTION 6		
6.1	$f'(x) = \frac{4}{x^2}$ $\therefore x^2 \geq 0$ $\therefore \frac{4}{x^2} > 0$	$\checkmark f'(x) = \frac{4}{x^2}$ $\checkmark x^2 \geq 0$ $\checkmark \frac{4}{x^2} > 0$
6.2	$m = -4$ <p><i>Perpendicular lines</i></p> $m = \frac{1}{4}$ $f'(x) = \frac{4}{x^2}$ $\frac{1}{4} = \frac{4}{x^2}$ $16 = x^2$ $\therefore x = -4 \quad y = -\frac{4}{-4} + 7$ $y = 8$ <p>Substitute (-4; 8)</p> $y = \frac{1}{4}x + c \quad \text{OR} \quad y - 8 = \frac{1}{4}(x + 4)$ $8 = \frac{1}{4}(-4) + c \quad y = \frac{1}{4}x + 9$ $c = 9$ $y = \frac{1}{4}x + 9$	$\checkmark m = \frac{1}{4}$ $\checkmark \frac{1}{4} = \frac{4}{x^2}$ $\checkmark \text{selecting } x = -4$ $\checkmark y = 8$ $\checkmark \text{answer}$
		(3)
		(5)
		[8]

QUESTION 7		
7.1 7.1.1	$f(x+h) = 1 - 4(x+h)^2$ $= 1 - 4x^2 - 8xh - 4h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{1 - 4x^2 - 8xh - 4h^2 - (1 - 4x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-8xh - 4h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-8x - 4h)}{h}$ $= -8x$	<p>✓ <math>f(x+h) =</math> <math>1 - 4x^2 - 8xh - 4h^2</math></p> <p>✓ correct substitution into correct formula</p> <p>✓ simplify <math>(-8xh - 4h^2)</math></p> <p>✓ common factor <math>h</math></p> <p>✓ <math>-8x</math></p> <p>(5)</p>
7.1.2	$f'(2) = -8(2)$ $= -16$	<p>✓ substitute <math>x = 2</math> into <math>f'(x)</math></p> <p>✓ answer</p> <p>(2)</p>
7.2 7.2.1	$y = x^2 - 4x + 4$ $\frac{dy}{dx} = 2x - 4$	<p>✓ expansion</p> <p>✓ <math>2x</math></p> <p>✓ <math>-4</math></p> <p>(3)</p>
7.2.2	$f(x) = x^{\frac{2}{3}} + \frac{1}{4}x^{-4}$ $f'(x) = \frac{2}{3}x^{-\frac{1}{3}} - x^{-5}$	<p>✓ <math>x^{\frac{2}{3}}</math></p> <p>✓ <math>\frac{1}{4}x^{-4}</math></p> <p>✓ <math>\frac{2}{3}x^{-\frac{1}{3}}</math></p> <p>✓ <math>-x^{-5}</math></p> <p>(4)</p>
		[14]

QUESTION 8		
8.1	$f(x) = (x+2)(x-1)(x-3)$ $= x^3 - 2x^2 - 5x + 6$	✓ factors $(x+2)(x-1)(x-3)$ ✓ product of any two factors ✓ product of any binomial and trinomial $x^3 + x^2 - 2x - 3x^2 - 3x + 6$ (3)
8.2	$f'(x) = 3x^2 - 4x - 5$ $0 = 3x^2 - 4x - 5$ $x = \frac{4 \pm \sqrt{16 + 60}}{6}$ $x = 2,12 \quad \text{OR} \quad x = -0,7$ $y = 8,21 \quad \text{OR} \quad y = -4,06$ $A(-0,79; 8,21) \quad B(2,12; -4,06)$	✓ $f'(x) = 0$  ✓ substitute into quadratic formula ✓ x-values  ✓ y-values (4)
8.3	$y = x^3 - 2x^2 - 5x + 6 - (2x)$ $= x^3 - 2x^2 - 7x + 6$ $\frac{dy}{dx} = 3x^2 - 4x - 7$ $= (3x - 7)(x + 1)$ <i>formax</i> $0 = (3x - 7)(x + 1)$ $x = \frac{7}{3} \quad \text{OR} \quad x = -1$ $y = (-1)^3 - 2(-1)^2 - 7(-1) + 6$ $PQ = 10$	✓ simplification $x^3 - 2x^2 - 7x + 6$  ✓ differentiation  ✓ factors  ✓ $\frac{dy}{dx} = 0$  ✓ x-values  ✓ answer (6)
8.4	$f'(x) = 3x^2 - 4x - 5$ $f''(x) = 6x - 4$ $6x - 4 < 0$ $x < \frac{2}{3}$ $k = \frac{2}{3}$	✓ $f''(x)$ ✓ $f''(x) < 0$  ✓ answer (3)
		[16]

QUESTION 9									
9.1	$BC = 50 - 2x$	✓ answer (1)							
9.2	$\begin{aligned} \text{Area} &= AB \times BC \\ &= x(50 - 2x) \\ &= 50x - 2x^2 \end{aligned}$ $\begin{aligned} \text{Max } A'(x) &= 50 - 4x \\ 0 &= 50 - 4x \\ x &= 12,5m \end{aligned}$	✓ $x(50 - 2x)$ ✓ simplification $(50x - 2x^2)$  ✓ differentiate  ✓ answer (4)							
<b>[5]</b>									
QUESTION 10									
10.1	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;"></th> <th style="width: 30%;">1<sup>st</sup> selection</th> <th style="width: 30%;">2<sup>nd</sup> selection</th> <th style="width: 25%;">Outcomes</th> </tr> </thead> <tbody> <tr> <td rowspan="9" style="vertical-align: middle; text-align: center;"> <p>The diagram shows a tree starting from a root on the left. Three main branches emerge:                             <ul style="list-style-type: none"> <li>Top branch: labeled <math>\frac{3}{10}</math>, leading to node P. From P, three sub-branches emerge:                                     <ul style="list-style-type: none"> <li>Top: labeled <math>\frac{2}{9}</math>, leading to node P.</li> <li>Middle: labeled <math>\frac{2}{9}</math>, leading to node G.</li> <li>Bottom: labeled <math>\frac{5}{9}</math>, leading to node B.</li> </ul> </li> <li>Middle branch: labeled <math>\frac{2}{10}</math>, leading to node G. From G, three sub-branches emerge:                                     <ul style="list-style-type: none"> <li>Top: labeled <math>\frac{3}{9}</math>, leading to node P.</li> <li>Middle: labeled <math>\frac{1}{9}</math>, leading to node G.</li> <li>Bottom: labeled <math>\frac{5}{9}</math>, leading to node B.</li> </ul> </li> <li>Bottom branch: labeled <math>\frac{5}{10}</math>, leading to node B. From B, three sub-branches emerge:                                     <ul style="list-style-type: none"> <li>Top: labeled <math>\frac{3}{9}</math>, leading to node P.</li> <li>Middle: labeled <math>\frac{2}{9}</math>, leading to node G.</li> <li>Bottom: labeled <math>\frac{4}{9}</math>, leading to node B.</li> </ul> </li> </ul> </p> </td> <td> <ul style="list-style-type: none"> <li>P → P: PP</li> <li>P → G: PG</li> <li>P → B: PB</li> <li>G → P: GP</li> <li>G → G: GG</li> <li>G → B: GB</li> <li>B → P: BP</li> <li>B → G: BG</li> <li>B → B: BB</li> </ul> </td> <td>                     ✓ first branches                       ✓ <math>\frac{2}{9}; \frac{2}{9}; \frac{5}{9}</math>                       ✓ <math>\frac{3}{9}; \frac{1}{9}; \frac{5}{9}</math>                       ✓ <math>\frac{3}{9}; \frac{2}{9}; \frac{4}{9}</math>                      ✓ all outcomes                 </td> </tr> </tbody> </table>		1 <sup>st</sup> selection	2 <sup>nd</sup> selection	Outcomes	<p>The diagram shows a tree starting from a root on the left. Three main branches emerge:                             <ul style="list-style-type: none"> <li>Top branch: labeled <math>\frac{3}{10}</math>, leading to node P. From P, three sub-branches emerge:                                     <ul style="list-style-type: none"> <li>Top: labeled <math>\frac{2}{9}</math>, leading to node P.</li> <li>Middle: labeled <math>\frac{2}{9}</math>, leading to node G.</li> <li>Bottom: labeled <math>\frac{5}{9}</math>, leading to node B.</li> </ul> </li> <li>Middle branch: labeled <math>\frac{2}{10}</math>, leading to node G. From G, three sub-branches emerge:                                     <ul style="list-style-type: none"> <li>Top: labeled <math>\frac{3}{9}</math>, leading to node P.</li> <li>Middle: labeled <math>\frac{1}{9}</math>, leading to node G.</li> <li>Bottom: labeled <math>\frac{5}{9}</math>, leading to node B.</li> </ul> </li> <li>Bottom branch: labeled <math>\frac{5}{10}</math>, leading to node B. From B, three sub-branches emerge:                                     <ul style="list-style-type: none"> <li>Top: labeled <math>\frac{3}{9}</math>, leading to node P.</li> <li>Middle: labeled <math>\frac{2}{9}</math>, leading to node G.</li> <li>Bottom: labeled <math>\frac{4}{9}</math>, leading to node B.</li> </ul> </li> </ul> </p>	<ul style="list-style-type: none"> <li>P → P: PP</li> <li>P → G: PG</li> <li>P → B: PB</li> <li>G → P: GP</li> <li>G → G: GG</li> <li>G → B: GB</li> <li>B → P: BP</li> <li>B → G: BG</li> <li>B → B: BB</li> </ul>	✓ first branches  ✓ $\frac{2}{9}; \frac{2}{9}; \frac{5}{9}$  ✓ $\frac{3}{9}; \frac{1}{9}; \frac{5}{9}$  ✓ $\frac{3}{9}; \frac{2}{9}; \frac{4}{9}$ ✓ all outcomes	(5)
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	10.2								
	10.2.1	$\begin{aligned} P(B, B) &= \frac{5}{10} \times \frac{4}{9} \\ &= 0,22 \quad \text{OR} \quad \frac{2}{9} \end{aligned}$	✓ $\frac{5}{10} \times \frac{4}{9}$ ✓ answer (2)						
	10.2.2	$\begin{aligned} P(G,P) &= \frac{3}{10} \times \frac{2}{9} + \frac{2}{10} \times \frac{3}{9} \\ &= 0,13 \quad \text{OR} \quad \frac{12}{90} \quad \text{OR} \quad \frac{2}{15} \end{aligned}$	✓ $\frac{3}{10} \times \frac{2}{9}$ OR $\frac{6}{90}$ ✓ $\frac{2}{10} \times \frac{3}{9}$ OR $\frac{6}{90}$ ✓ answer (3)						
	<b>[10]</b>								

QUESTION 11		
11.1	Letters : $26 - 6 = 20$ Digits: $0 - 9 = 10$  $20^4 \times 10^4$ $= 1\,600\,000\,000$	$\checkmark 20^4$ $\checkmark 10^4$ $\checkmark$ answer  (3)
11.2 11.2.1	$P'(A) = 1 - P(A)$ $0,45 = 1 - P(A)$ $P(A) = 0,55$  $P(A \text{ or } B) = P(A) + P(B)$ $= 0,55 + 0,35$ $= 0,9$	$\checkmark P(A)$  $\checkmark$ substitute in correct formula $\checkmark$ answer  (3)
11.2.2	$P(A) \times P(B)$ $= 0,55 \times 0,35$ $= 0,1975$ <b>OR</b> $\frac{77}{400}$  $P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$ $= 0,55 + 0,35 - 0,1975$ $= 0,71$ <b>OR</b> $\frac{283}{400}$ <b>OR</b> $\frac{71}{100}$	$\checkmark 0,55 \times 0,35$ $\checkmark 0,1975$ <b>OR</b> $\frac{77}{400}$  $\checkmark$ substitute in correct formula $\checkmark$ answer  (4)
		<b>[10]</b>
		<b>TOTAL: 150</b>