MATHEMATICS SPECIALIST 3,4
TEST 2 SECTION ONE 2016
NON Calculator Section
Chapters 3 and 4

Name_____ **Time: 35 minutes**
Total: 35 marks

Question 1 **(7 marks)**

Two functions are defined as $f(x)=\sqrt{x-1}$ and $g(x)=\frac{1}{x-1}$

(a) Evaluate $gf\left(\frac{13}{9}\right)$ (2 marks)

(b) Find in simplified form $gg(x)$. (2 marks)

(c) Determine the domain of $f(g(x))$ (3 marks)

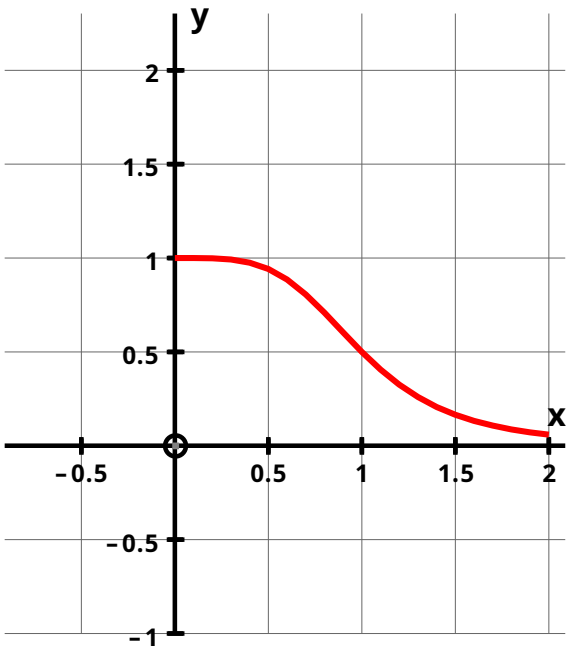
Question 2 **(6 marks)**

(a) Determine the domain and range of $f(g(x))$ given that $f(x)=\frac{12}{x+1}$ and $g(x)=\sqrt{x+1}$ (3)

(b) Given that $f(x)=2x+3$ and $g(f(x))=4x^2+12x+11$, find $g(x)$. (3)

Question 3 **(6 marks)**

The graph of function $f(x)=\frac{1}{x^4+1}$ for the domain $0<x<2$ is shown below.



(a) Determine the exact value for $\lim_{x\to 2^+} f(x)$ (2)

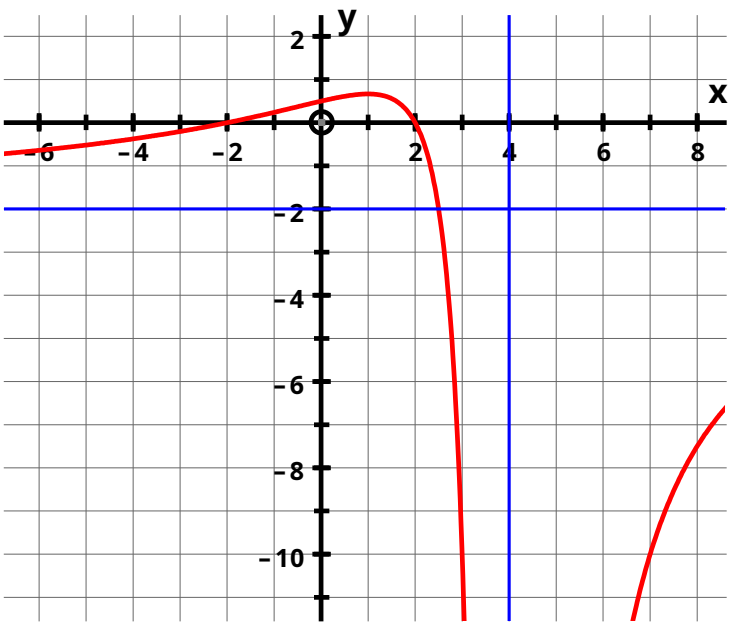
(b) On the axes given above, sketch the graph of the inverse function, $y=f^{-1}(x)$ (2)

(c) Obtain the rule for $f^{-1}(x)$. (2)

Question 4 **(5 marks)**

A rational function $R(x)$ is sketched below. Function $R(x)$ has the following properties:

- Only one pole or a discontinuity at $x=4$
- Two horizontal intercepts at $x=2$ *and* $x=-2$.
- A horizontal asymptote at $y=-2$



(a) If $R(x)=\dfrac{k(x^2-a)}{(x-b)(x-c)}$ explain why $k=-2,\ a=4,\ b=4$ *and* $c=4$

(4)

(b) Determine $\lim_{x \to 4} R(x)$.

(1)

Question 5 **(7 marks)**

Solve the following.

(a) $|x - 2| > 4$ (1)

(b) $|x - 7| \leq |x - 11|$ (2)

(c) $\left|3x+4\right| \geq \left|5x+2\right|$ (2)

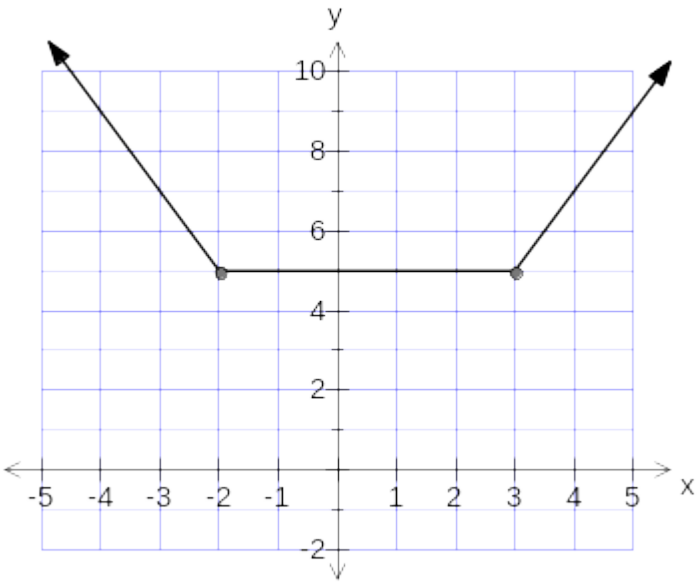
(d) $\left|x-6\right| \leq 4x+3$ (2)

MATHEMATICS SPECIALIST 3,4
TEST 2 SECTION TWO 2016
Calculator Section
Chapters 3 and 4

Name_____ **Time: 20 minutes**
Total: 20 marks

Question 1 **(5 marks)**

The function *f*, defined for all real *x* by $f(x)=|x-a|+|x+b|$, where *a* and *b* are positive integers, has the following graph.



(a) Find the values of *a* and *b*.

(b) Express $f(x)$ as a piecewise function.

Question 2 **(5 marks)**

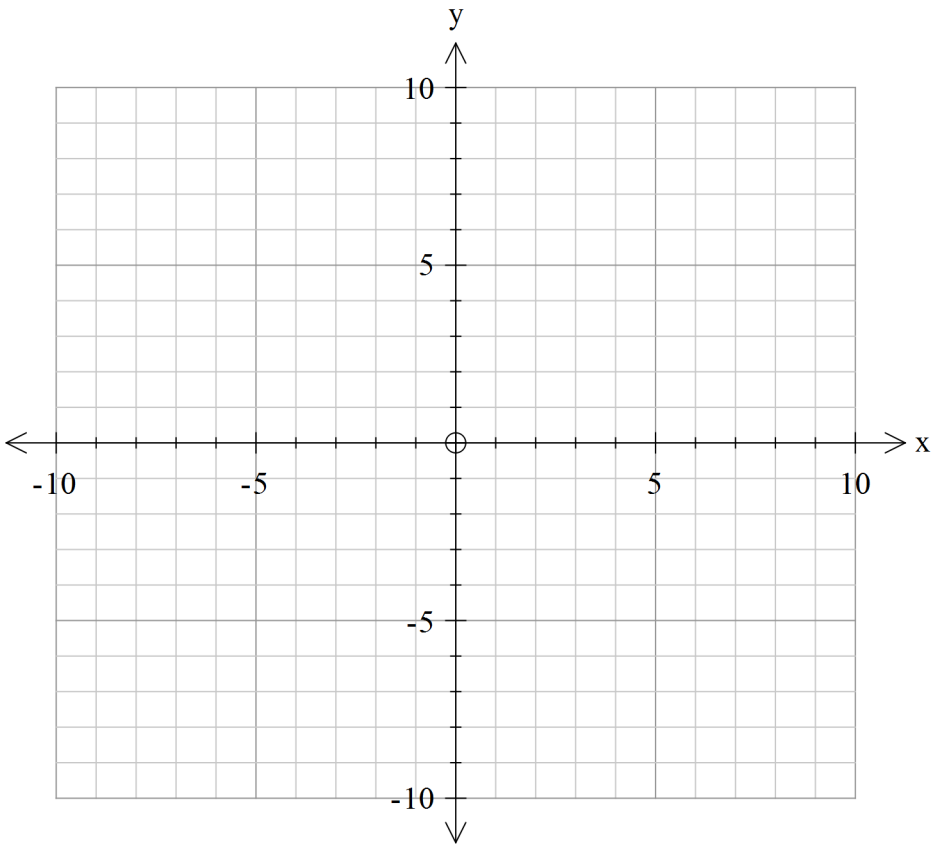
At 10.00am, two bumper cars at the royal show, G and T, have position vectors, ***r*** m, and velocity vectors, ***v*** m/s, as shown below:

$$r_G = 3i + 9j \quad v_G = -i - j$$
$$r_T = 9i \quad v_T = -5i + 5j$$

Prove that the bumper cars will collide if they continue with these velocities and find the time and location of the collision.

Question 3 **(5 marks)**

Sketch the graph $y=\frac{x^3}{(x+4)(2x-3)}$, the asymptotes and describe the behaviour of the graph as $x \to \pm\infty$. Give the equations for the vertical and other asymptotes.



Question 4 **(5 marks)**

Find the Cartesian equation of the line perpendicular to the vector $7\underline{i}+5\underline{j}$ and passing through the point $(-1,3)$