

**Question 1:**

(a)[4 points] Express as a single simplified fraction:

$$\frac{x}{x+1} + \frac{1}{x-1}$$

(b)[3 points] Expand and simplify:

$$2\left(\frac{a+b}{2}\right)^2 - \left(\frac{a^2+b^2}{2}\right)$$

(c)[3 points] Simplify using only positive exponents:

$$\left(\frac{(2x)^3y^{-3}}{x^{-3}(2y)^{-2}}\right)$$

**Question 2:**

(a)[5 points] Solve and state your answer using interval notation

$$-3 \leq \frac{2}{3} - 5x \leq 2$$

(b)[5 points] Solve and state your answer using interval notation

$$x^2 + x > 12$$

**Question 3:**

(a)[4 points] Solve for  $x$

$$\left| \frac{5x - 3}{7} \right| = \frac{1}{2}$$

(b)[6 points] Solve and state your answer using interval notation

$$\left| \frac{8 - 11x}{-3} \right| \geq 5$$

**Question 4:**

(a)[5 points] The distance from  $(-2, 5)$  to  $(a, a)$  is 9 units. Find all possible values of  $a$ .

(b)[5 points] Find the points of intersection of the graphs of  $y = 2x^2 - 3x + 1$  and  $3x - y + 9 = 0$ .

**Question 5:**

(a)[4 points] Put the equation of the following circle in standard form and state the centre and radius

$$x^2 + y^2 - 3x + 5y = 11$$

(b)[3 points] Find the  $x$  and  $y$  intercepts of the graph of  $y = \frac{(x^2 - 1)(x^2 + 2)}{x^2 - 3}$ .

(c)[3 points] Find the zeros of  $f(x) = x\sqrt{2x - 7} - 7\sqrt{2x - 7}$ .

**Question 6:**

(a)[3 points] Find the domain of  $f(x) = \frac{2\sqrt{9-x}}{x}$ .

(b)[7 points] Factor completely

$$f(x) = x^4 + 2x^3 - 2x^2 - 6x - 3$$

**Question 7:**

(a)[5 points] Find the equation of the line through the midpoint of  $(-1, -7)$  and  $(7, 6)$  which is parallel to the line  $5x - 3y - 4 = 0$ .

(b)[5 points] Put the parabola  $y = -x^2 + 6x + 7$  in standard form and state the vertex and axis of symmetry.

**Question 8:**

(a)[5 points] Apply transformations to sketch the graph of  $y = 3 - 2\sqrt{-x}$ .

(b)[5 points] Using your result from (a) sketch the graph of  $y = |3 - 2\sqrt{-x}|$ . Label the  $x$  and  $y$  intercepts on your graph.



**Question 9:**

(a)[5 points] Let  $f(x) = \frac{3x}{x-6}$ . Find  $f^{-1}(x)$  and state its domain and range.

(b)[3 points] Suppose  $(-3, 1/2)$  is on the graph of  $y = g(x)$  for some one-to-one function  $g$ .  
Evaluate

$$6g(-3) + 2g^{-1}(1/2)$$

(c)[2 points] Let  $F(x) = \frac{1 + (\sqrt{x} + 2)^2}{\sqrt{x} + 2}$ . Find functions  $f$  and  $g$  so that  $F = f \circ g$ .

**Question 10:** A farmer wishes to construct a rectangular enclosure parallel to a straight road. the fencing for three sides of enclosure costs \$12 per metre, while the fencing for the side next to the road costs \$18 per metre since it must be taller than the other three sides. \$4800 is available for the project.

(a)[5 points] Let  $x$  represent the length of the side parallel to the road and  $A(x)$  the area of the enclosure as a function of  $x$ . Find a formula for  $A(x)$  and state the domain.

(b)[5 points] Find the dimensions of the enclosure of maximum possible area.