

**Name:**

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**Instructions:**

- Attempt all questions.
- The test is out of 100 marks.
- There are 10 questions, 10 marks each.
- You have 60 minutes to complete the test.
- You may use calculators on this test.

**Advice:**

- Budget your time.
  - Do questions which you know how to do immediately first.
  - Leave questions which you find difficult until last.
  - Ask for clarification if you do not understand a question.
  - You must show your work. Label sketches well.
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**Problem 1.** (10 marks) For the quadratic function  $f(x) = 14x^2 - 2x + 3$ , convert to the vertex form  $f(x) = a(x - h)^2 + k$  by completing the square. Identify the vertex and axis of symmetry for this quadratic function. You must use completing the square in this problem.

**Problem 2.** (10 marks) Given  $f(x) = \frac{1}{x+1}$ , simplify the quantity  $\frac{f(x+h) - f(x)}{h}$  as much as possible. You should simplify until substituting zero for  $h$  will not yield an indeterminate form.

**Problem 3.** (10 marks) Find the remainder  $r(x)$  when  $g(x) = -4x^3 - 2x + 3$  is divided by  $d(x) = x - 8$  using long division of polynomials.

**Problem 4.** (10 marks) Sketch the polynomial  $f(x) = (3x - 1)^2(2 - x)^3$  by hand. Show all your work.

**Problem 5.** (10 marks) For the function  $g(x)$  given below, determine what monomial the function approaches for large  $|x|$ . Then, evaluate  $\lim_{x \rightarrow \infty} g(x)$  and  $\lim_{x \rightarrow -\infty} g(x)$ . Does the function  $g(x)$  have any horizontal asymptotes?

$$g(x) = \frac{(-3x^3 + 24x - 78)(-x + 1)}{2x^3 - 99}$$

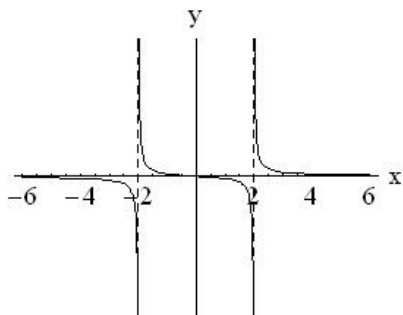
**Problem 6.** (10 marks) Sketch the rational function  $h(x) = \frac{(x + 6)^3}{2(x^2 - 4)}$  by hand (find  $x$ -intercepts, vertical asymptotes, slant or horizontal asymptotes, and end behaviour).

**Problem 7.** (10 marks) Solve the inequality  $\frac{(3x + 5)|x - 2|}{x - 5} < 0$  by constructing a sign chart. Show your work.

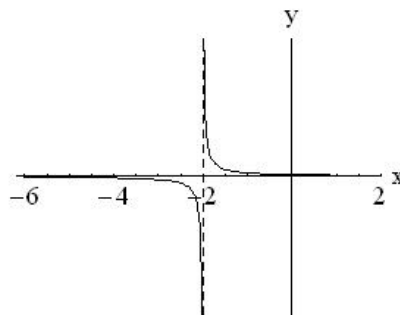
**Problem 8.** (10 marks) Solve the inequality  $\frac{1}{x + 2} + \frac{1}{x - 2} \leq 0$  by constructing a sign chart, or drawing an appropriate sketch by hand. Show all your work. *Hint:* Simplify first to get a rational function on the left hand side.

**Problem 9.** (10 marks) Solve  $\frac{3x}{x+1} + \frac{5}{x-2} = \frac{15}{x^2-x-2}$  for  $x$ .

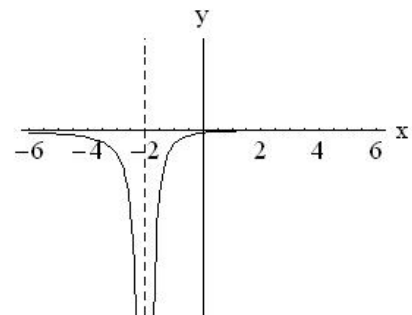
**Problem 10.** (10 marks) Match the graph to the function.



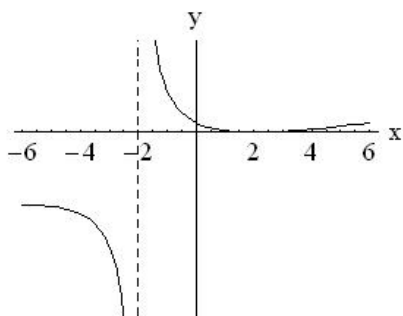
Function:-----



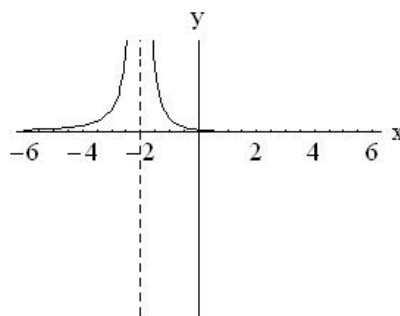
Function:-----



Function:-----



Function:-----



Function:-----

A)  $y = \frac{1}{x^2 + 4}$

B)  $y = \frac{2x}{(x-2)(x+2)}$

C)  $y = \frac{x-2}{(x+2)^2}$

D)  $y = \frac{1}{x+2}$

E)  $y = \frac{(x-2)^2}{x+2}$

F)  $y = \frac{2-x}{(x+2)^2}$