True/False (1 mark each)
Indicate whether the statement is true or false.

1. The reciprocal of every linear function has a vertical asymptote.

2. An even function is symmetrical about the origin.

3. $f(x) = \frac{1}{(x-5)^2}$ is always positive.

4. All polynomial functions that are members of the same family will have the same x-intercepts.

5. $f(x) \to +\infty$ as $x \to 2^-$ for the function $f(x) = \frac{1}{3x-6}$?

Multiple Choice (1 mark each)
Identify the choice that best completes the statement or answers the question.

6. Which of the reciprocal functions has a vertical asymptote at $x = \frac{5}{2}$?

a. $f(x) = \frac{1}{x + \frac{5}{2}}$

b. $f(x) = \frac{1}{2x+5}$

c. $f(x) = \frac{5}{x+2}$

d. $f(x) = \frac{1}{2x-5}$

7. Which of the following has a horizontal asymptote at $y = 0$?

a. $f(x) = \frac{1}{3-x}$

b. $f(x) = \frac{1}{17x+4}$

c. $f(x) = -\frac{1}{x+2}$

d. all of the above

8. What is the *x*-intercept of $f(x) = \frac{1}{3x-4}$?

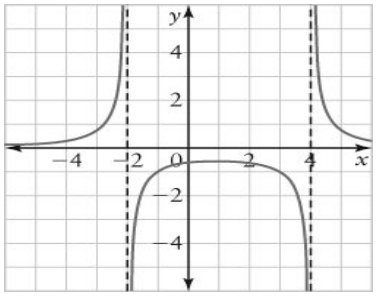
a. $-\frac{1}{4}$

b. $\frac{4}{3}$

c. $\frac{1}{4}$

d. There is no *x*-intercept.

9. Over what interval(s) is the graph of the rational function decreasing?



a. $-2 < x < 4$

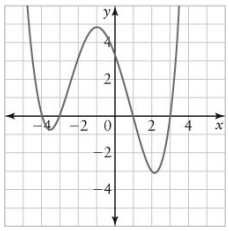
b. $-2 < x, x \neq 4$

c. $x > 1, x \neq 4$

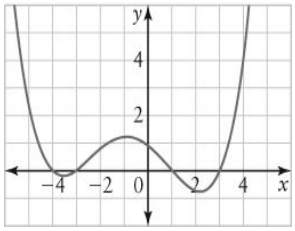
d. $x < -2, -2 < x < 1$

10. Which graph does not belong to the same family?

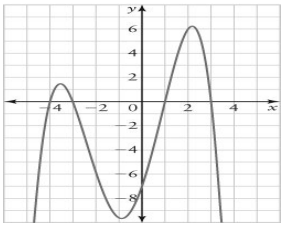
a.



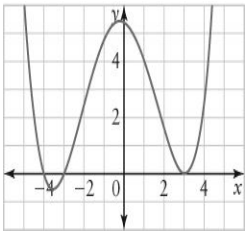
b.



c.



d.



11. (10 marks) Based on the function $f(x) = \dfrac{2x-4}{x+4}$, fill-in the following table of characteristics.

x-intercept(s)	
y-intercept	

Domain	
range	
vertical asymptote(s)	
horizontal asymptote	
positive interval	
negative interval	
intervals of increase	
intervals of decrease	

12. (2 marks) Determine whether the following functions are odd, even, or neither.

a) $f(x) = \dfrac{x^2}{(x-2)^3}$

b) $f(x) = \dfrac{x^2}{x^2+1}$

Application

13. (4 marks) Describe how the graph of $y = -2f[3(x-1)] - 4$ can be obtained from the graph of f(x) = x^4. Be sure to use full sentences when describing the transformations.

14. The population of a small town is modelled by the function $P(t) = \frac{20(4t+3)}{2t+5}$, where $P(t)$ is the population, in thousands, and t is time, in years, since the start of 1990.

    a) (2 marks) Is the population currently increasing or decreasing? Justify your answer.

    b) (2 marks) The town will need its own transit system if the population exceeds 50 000. Will the town's population ever exceed 50 000? Explain. (2 marks)

15. (4 marks) Polluted water from a factory flows into a pond. The concentration of pollutant, c, in the pond at time t minutes is modelled by the equation $c(t) = 8 - 8000\left(\frac{1}{1000+2t}\right)$, where c is measured in kg/m^3. When will the concentration of pollutant in the pond reach 6 kg/m^3?

Thinking

16. (5 marks) Solve $\frac{2x-1}{x-5} > \frac{x+1}{x+5}$

17. The following set of points belong to a specific function: {(-3,0)(-2,4), (-1,0), (0,-6),(1,-8), (2,0),(3,24)} Based on the set of points answer the following questions:

    a) (2 marks) What type of function does the set of points produce? Justify your answer.

    b) (3 marks) Write an equation for this function based on the set of points that have been given.

18. a) (2 marks) Create a simplified function that represents the sum of an unknown **positive** number x and its reciprocal.

b) (2 marks) For what whole number is the sum of the number and its reciprocal the smallest? In your solution, you may want to include a graph the function.