Review Calculus Final Exam 2020/2021 Name ______________________

1) $\lim_{x\to 3} \frac{x^2-5x+6}{x-3}=$

2) $\lim_{x\to 3} \frac{x-3}{x^2-9} =$

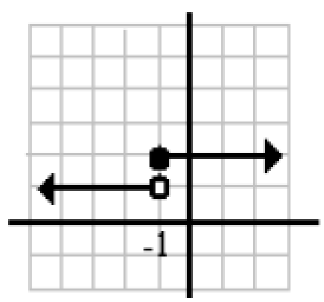
3) $\lim_{x\to 9} \frac{\sqrt{x}-3}{x-9} =$

4) a) $\lim_{x\to -1^-} f(x) =$

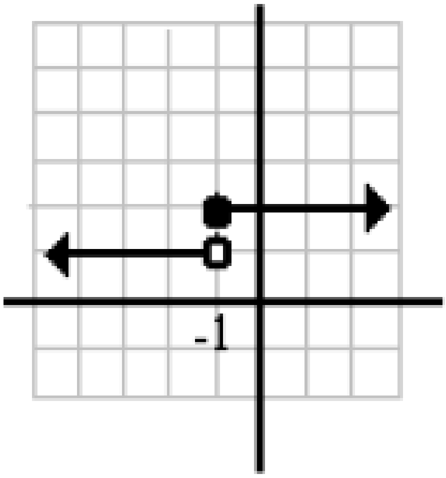
b) $\lim_{x\to -1^+} f(x) =$

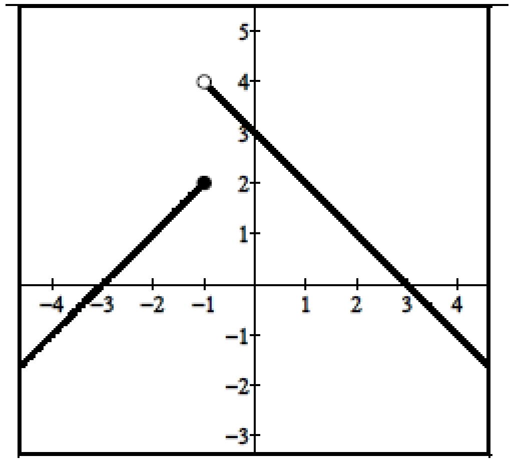
c) $\lim_{x\to -1} f(x) =$

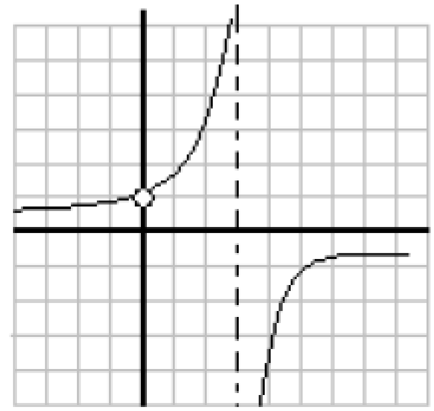
d) $f(-1) =$



5) For each graph, list any points of discontinuity and for any point of discontinuity state if it is removable or non-removable.







Find the derivative for problems 6 - 17:

6) $f(x) = 3x^4 + 5x^2 - 3x + 2 + 7x^{-1}$

7) $f(x) = -2x^4 + 4x^3 - 3x^2 + 2 + \frac{3}{x}$

8) $f(x) = 5x^2(x - 1)$

9) $f(x) = (x^2 + 5)(3x - 1)$

10) $f(x) = (1 - 4x^3)(3x^2 - 5x + 2)$

11) $g(t) = (t^2 + 1)(t^3 + t^2 + 1)$

12) $g(t) = \frac{t-1}{t^2+2t+1}$

13) $f(x) = \frac{x^2-4}{x^2+4}$

14) $g(x) = \frac{3x}{x^3+7x-5}$

15) $y = (x^2 + 3x + 4)^3$

16) $y = \sqrt{-2x + 3}$

17) $y = \sqrt[3]{5 + 7b}$

18) Water is falling on a surface, wetting a circular area that is expanding at a rate of $8mm^2/sec$. How fast is the radius of the wetted area expanding when the radius is 188mm?

19) A ladder is slipping down a vertical wall. If the ladder is 10 ft long and the top of it is slipping at a constant rate of 3 ft/sec.

a) How fast is the bottom of the ladder moving along the ground when the bottom of the ladder is 8 ft from the wall?

20) A spherical balloon is inflated with helium at the rate of $100\pi ft^3/min$.

a. How fast is the balloon's radius increasing at the instant the radius is 5 feet? ($V = 4\pi r^3$)

b. How fast is the surface area increasing at that instant? (S.A. = $4\pi r^2$)

For problems 21 & 22, use implicit differentiation to solve for ${dy}/{dx}$,

21) $x^2y + y = 3$

22) $x^2 + y^2 - xy + 3x - 9 = 0$

For problems 23 – 25. Find the x-coordinate of the critical values, interval of increase and decrease. Intervals of concave up and concave down, any minimum and maximum points, and any points of inflection.

23) $f(x) = 2x^3 - 3x^2 - 36x + 4$

Inc:

Dec:

Min:

Max:

Conc Up:

Conc Dn:

POI:

24) $(x) = 2x^3 + 6x^2 + 6x + 7$

Inc:

Dec:

Min:

Max:

Conc Up:

Conc Dn:

POI:

25) $f(x) = 3x^4 - 4x^3 - 5$

Inc:

Dec:

Min:

Max:

Conc Up:

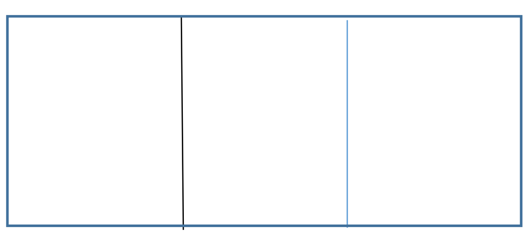
Conc Dn:

POI:

26) A farmer has 100 feet of fence and wishes to enclose a rectangular plot of land. The land borders a river so no fence is required on that side. What should the dimensions of the rectangle be in order that it include the largest area possible?

27) A manufacturer wants to design an open box (no top) having a square base and a surface are of 108 in^2. What dimensions will produce a box with maximum volume?

28) An ecologist is conducting a research project on breeding pheasants in captivity. She must first construct suitable pens. She wants a rectangular region with two additional fences as shown in the diagram. Find the maximum area that can be enclosed with 3000m of fencing. (Assume that the interior fences do not take up any area and maximize the area of the large rectangle.)



29) $\int (x^7 - 6x + 8)$

30) $\int \left(x^3 - \frac{1}{x^3}\right)$

31) $\int \left(x^2 - 2x + \frac{8}{x^2}\right)$

32) $\int_{-3}^{0} (x^2 + 2x - 2)$

33) $\int_{1}^{2} (x^4 - x^3) dx$

34) $\int_{-1}^{2} (3x^2 + 2x + 4) dx$