

Part I. Problems in this section are mostly short answer and multiple choice. Little partial credit will be given. 5 points each.

1. Factor completely.

a) $6x^2 + 15x - 9$

b) $4x^3 + 2x^2 - 6x - 3$

2. Find the domain of the function $g(x) = \frac{2}{\sqrt{x-1}}$.

a) $(-\infty, \infty)$

b) $(-\infty, 1)$

c) $(-\infty, 1]$

d) $(1, \infty)$

e) $[1, \infty)$

3. Expand the logarithm as the sum or difference without exponents.

$$\log_2 \left(\frac{7x^3}{yz^4} \right)$$

4. Find the quotient and remainder.

$$(x^3 + 2x + 3) \div (x - 1)$$

Quotient: _____

Remainder: _____

5. Let $f(x) = x^2 + 2x$ and $g(x) = 3x - 5$.

a) Find and simplify $(f - g)(1)$.

b) Find and simplify $f(g(x))$.

6. Solve: $\frac{4}{x-3} - \frac{3}{x+3} = \frac{18}{x^2-9}$

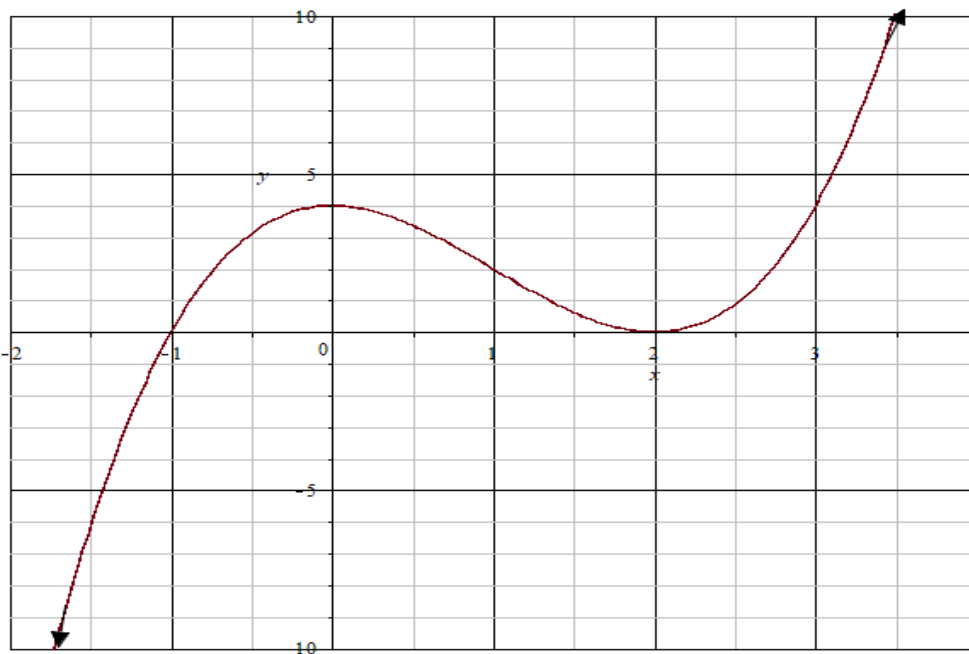
7. Simplify the following to $a + bi$ form.

$$(3 + 2i)(3 - 2i) + (2i)^3$$

8. Given the graph of $f(x)$, state in interval form all x such that:

a) $f(x)$ is increasing

b) $f(x) \geq 0$

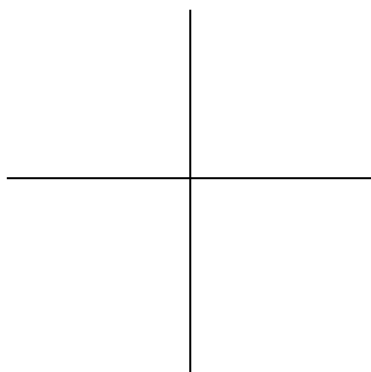


9. Solve for x : $y = \sqrt[3]{2x+3}$

10. Solve for x : $|3x-4|-2=10$

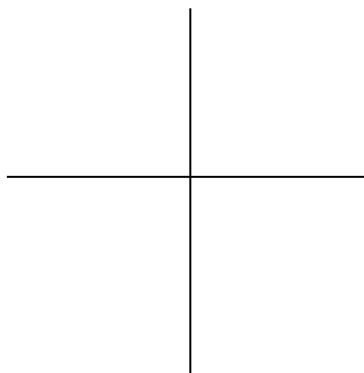
11. Graph each function. Label all intercepts and asymptotes.

$$f(x) = e^{-x} - 2$$



Intercept in (x, y) form: _____
Equation of asymptote: _____

$$g(x) = \ln(x-2)$$



Intercept in (x, y) form: _____
Equation of asymptote: _____

12. Find a 3rd degree polynomial (in polynomial form) with zeros: -1 and $3i$.

13. Find a formula for the inverse given $f(x) = \frac{5x-2}{3x+7}$.

14. Evaluate each.

a) $\log_2 1 =$ _____

c) $\log(0.01) =$ _____

b) $\log_5 125 =$ _____

d) $\ln e^{(1/8)} =$ _____

e) $\log_{16} 4 =$ _____

***Part II. There are 9 problems in this section. Partial credits will be awarded.
Show all work. 10 pts. each.***

15. Solve: $x^4 + x^2 - 20 = 0$ (Include real and complete solutions.)

16. Given the function $f(x) = x^2 + 2x - 3$

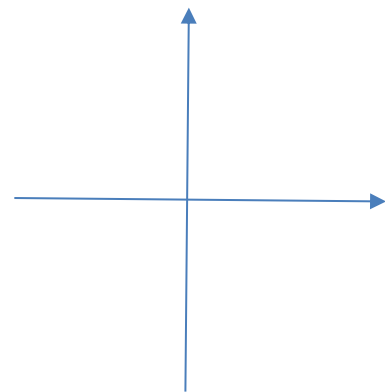
a) State the y-intercept.

b) State the zeros of the function.

c) The vertex is (_____, _____).

d) Maximum/minimum value = _____.

e) Graph. Label intercepts and vertex.



17. Given the function $f(x) = -(x-2)^2(x+1)(x-1)$

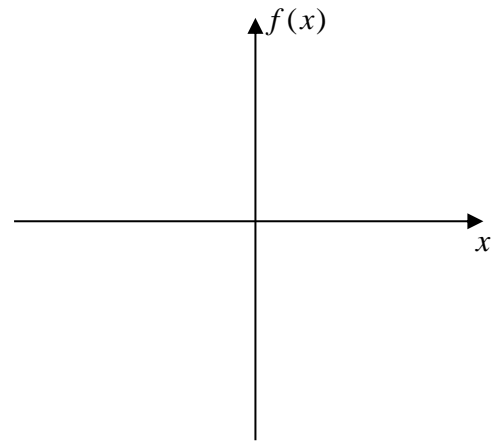
a) Find y-intercept.

b) Find zeros and state their multiplicities.

Zero	Multiplicity

c) Is $f(x)$ tangent to the x -axis?
If so, where?

c) Draw ending behavior.



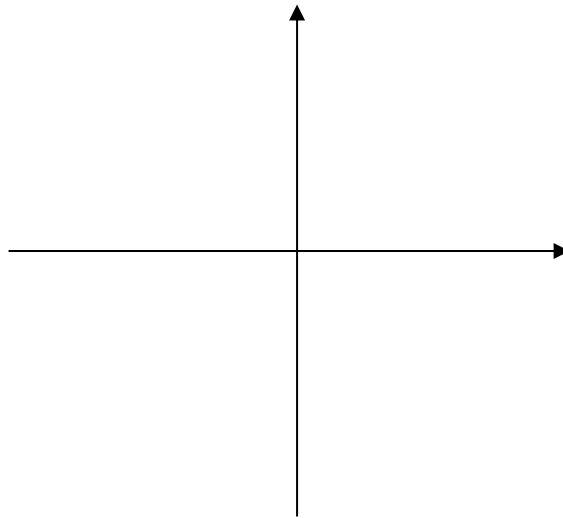
e) Sketch graph. Label all intercepts.

18. Given the polynomial $g(x) = x^3 + x - 10$

a) State all possible rational zeros.

b) Find all zeros (real and complex.)

19. Find all asymptotes, x -intercepts, and y -intercepts for the graph $f(x) = \frac{2x-3}{x+1}$.
- a) The equation of the vertical asymptote(s) is/are $x = \underline{\hspace{2cm}}$.
 - b) The equation of the horizontal asymptote(s) is/are $y = \underline{\hspace{2cm}}$.
 - c) The x -intercept is at the point $\underline{\hspace{2cm}}$.
 - d) The y -intercept is at the point $\underline{\hspace{2cm}}$.
 - e) Sketch the graph of $f(x)$. **Label all intercepts and asymptotes.**



20. Solve the system algebraically.

$$3x - y = 7$$

$$2x + 3y = 1$$

21. Solve the exponential equations for x .

a) $3^{x^2+4x} = \frac{1}{27}$

b) $e^x - 6e^{-x} = 1$

22. Solve the logarithmic equations for x .

a) $\log_5(3x+10) = 2$

b) $\ln x = -2$

23. Solve $\sqrt{3x+1} + 3 = x$. **Check all solutions.**

Part III. There are 6 problems in this section. Choose any 4. Indicate in the boxes the problems you want graded. 10 points each.

- Grade? 24. A bacteria culture starts with 500 bacteria and after 3 hours there are 8000 bacteria. Assuming that the growth model is exponential ($P = P_0 e^{kt}$). Set up the exponential function, and solve for k . Leave your answer in exact form since no calculators are allowed.

- Grade? 25. The points $(-2, 4)$ and $(6, 2)$ are the endpoints of the diameter of a circle.
- a) State the center and the radius.

b) State the equation of the circle in standard form.

Grade 26. A toy rocket is fired into the air from the top of a barn. Its height (h) above the ground in yards after t seconds is given by the function $h(t) = -5t^2 + 10t + 20$. Show your work algebraically and include units on answers.

a) What was the initial height of the rocket?

b) When did the rocket reach its maximum height?

c) What was the maximum height the rocket reaches?

Grade 27. Solve $\frac{x+2}{x-3} \geq 0$ algebraically. Express your answer in interval notation.

28. Simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$ for $f(x) = 2x^2 - 3x + 1$.
Grade

29. Solve and check answers. $\log(x) + \log(x - 3) = 1$
Grade