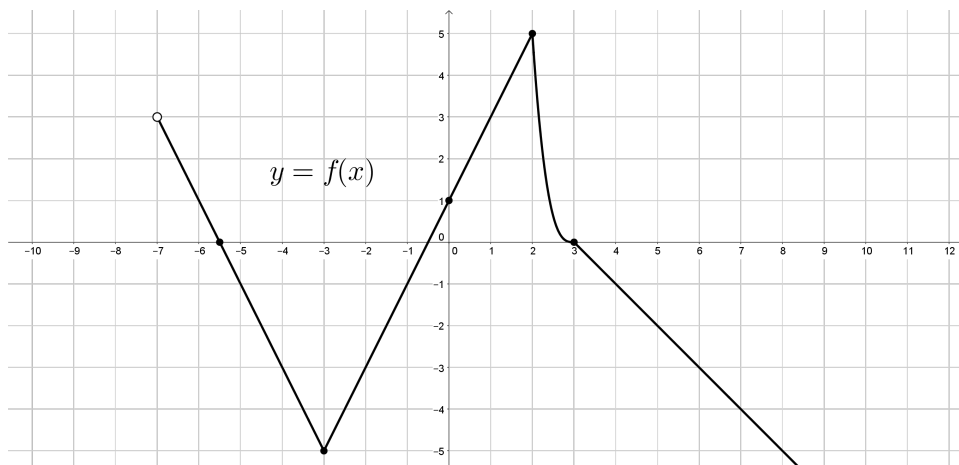


[4] 1. Suppose $y = f(x)$ is given by the following graph:



- (a) State the domain and range of $f(x)$.
 (b) Evaluate: $2f(-3) + f(-6)$
 (c) Evaluate: $(f \circ f)(1)$
 (d) Does f have an inverse? Why or why not?
- [2] 2. Find the equation for the line with y -intercept $(0, 3)$ that is perpendicular to the line given by $2x - 3y = 4$. Give your answer in the form $y = mx + b$.
- [4] 3. Let $f(x) = \begin{cases} 2x - 1 & \text{if } 0 \leq x \leq 2 \\ x + 2 & \text{if } x > 2 \end{cases}$
 (a) Sketch a graph of $y = f(x)$.
 (b) State the domain and range of $y = f(x)$.
 (c) Given that f has an inverse, state the domain and range of $f^{-1}(x)$.
- [3] 4. Simplify and express the answer with positive exponents only: $\frac{10(a^3b^{-2})^{-3}(a^{-1}b^{11})^0}{(-2a)^4}$
- [2] 5. Factor completely.
 (a) $3x^2 + 8x + 5$ (b) $125x^3 - 64$
- [6] 6. Solve for x using the specified method.
 (a) $3(3x - 1)^2 - 8 = 19$ (taking square roots)
 (b) $(x - 3)(x + 2) = 14$ (factoring)
 (c) $x^2 + 4899 = 140x$ (completing the square)
- [3] 7. Use polynomial long division to express $\frac{5x^3 + 3x - 5}{x + 1}$ in the form $Q(x) + \frac{R(x)}{D(x)}$, where the degree of $R(x)$ is less than degree of $D(x)$.
- [4] 8. Let $f(x) = \frac{x^2 - 9x - 36}{x^2 - 5x}$, let $g(x) = \frac{x - 12}{x}$, and let $h(x) = \frac{f(x)}{g(x)}$.
 (a) Simplify $h(x)$. (b) Find a formula for $g^{-1}(x)$.
- [4] 9. Solve for x : $\frac{x}{x - 3} + \frac{5}{2x - 1} = \frac{15}{2x^2 - 7x + 3}$
- [3] 10. Given the quadratic function $f(x) = 2x^2 - 2x + \frac{1}{2}$;
 (a) Find all intercepts. (b) Find the vertex. (c) Sketch a graph of the function.

- [3] 11. Given the rational function $f(x) = \frac{x^2 - 18x + 17}{x^3 - 17x^2 + 16x}$;
- (a) State the domain of $f(x)$.
(b) Give the equations of all vertical asymptotes (if any).
(c) Give the equations of all horizontal asymptotes (if any). Do **not** sketch.
- [4] 12. Given the rational function $f(x) = \frac{2 - 2x}{x - 2}$;
- (a) Find all intercepts. (b) Find all asymptotes. (c) Sketch a graph of the function.
- [2] 13. Let $A = (1, -1)$ and $B = (-2, 5)$. Compute the distance between A and B .
- [3] 14. Reduce the radical expression: $\sqrt[3]{-8x^7y^4} \sqrt[3]{81x^2y^3}$
- [2] 15. Rationalize the denominator and simplify: $\frac{10}{2\sqrt{2} + \sqrt{3}}$
- [2] 16. Find the domain of $f(x) = \frac{\sqrt{5-x}}{\sqrt{x-3}}$.
- [3] 17. Solve: $x - 2 - \sqrt{6 - 3x} = 0$.
- [2] 18. Sweden would like to open an account in order to prepare for a catastrophic event. If the country can deposit \$3 000 000 (which is probably more than enough) at 4% interest rate compounded semi-annually, find the balance in the account after ten years. (Give your answer to the **nearest dollar**.)
- [4] 19. Given the function $y = 2^{(1-x)} - 4$;
- (a) Find all intercepts. (c) Sketch a graph of the function.
(b) Find the equation of any asymptotes.
- [4] 20. Given the function $y = -2 \log_2(x + 4)$;
- (a) Find all intercepts. (c) Sketch a graph of the function.
(b) Find the equation of any asymptotes.
- [3] 21. Express in terms of the simplest possible logarithms: $\log \left(\frac{\sqrt{2x+1}}{100^x(x-3)^{8/3}} \right)$
- [3] 22. Compress into a single logarithm and simplify the result: $\ln(x^3y) + 2 \ln(\sqrt{xz}) - 3 \ln(xyzy)$
- [1] 23. Evaluate to four decimal places: $\log_6(12)$
- [6] 24. Solve the following equations for x :
- (a) $\log_3(x+3) = 3 - \log_3(x+9)$ (b) $4^{x+5} = 8 \cdot \left(\frac{1}{2}\right)^{7-x}$
- [3] 25. Suppose $\cos(\theta) = \frac{3}{7}$.
- (a) Find the exact value of $\tan(\theta)$ if θ is acute.
(b) Find the exact value of $\tan(\theta)$ if θ is in the 4th quadrant.
- [2] 26. Find the exact value of $\csc(7\pi/6)$.
- [2] 27. Find all θ in $[0^\circ, 360^\circ)$ that satisfy $\sin(\theta) = -\frac{5}{6}$. (Answer in degrees to three decimal places.)
- [2] 28. Find all θ in $[0, 2\pi)$ such that $\cot(\theta)$ is undefined. (Give an exact value in radians.)

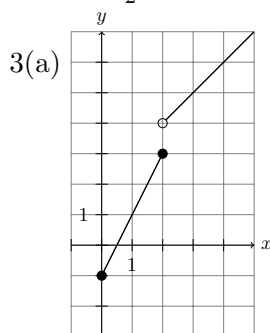
- [3] 29. A math teacher stands in front of the classroom (Say HO-214) looking directly at the back row, which is 3m away. If she turns 20° degrees to the right, she will be looking at Xavier, who is in the back row. If she turns 40° to the left, she will be looking at Yannick, who is also in the back row. How far apart are Xavier and Yannick? (Answer in metres with 3 decimal places of precision.)
- [3] 30. Given the function $y = -3 \cos\left(\frac{x}{2}\right)$;
- (a) State the amplitude A and the period P . (b) Sketch a graph. (At least two cycles.)
- [4] 31. A triangle has sides of length a, b, c across from angles of measure A, B, C respectively. Suppose $A = 35^\circ, b = 7$ and $c = 3$. Find a, B , and C . (Give three decimal places.)
- [2] 32. Simplify: $(\csc x - \cot x)(\csc x + \cot x)$
- [2] 33. Prove the identity: $\frac{1}{\sin x + \cos x} = \frac{\sec x}{1 + \tan x}$

END OF EXAM

ANSWERS:

- 1(a) $D = (-7, \infty), R = (-\infty, 5]$
 1(b) -9
 1(c) 0
 1(d) No. It fails the horizontal line test.

2. $y = -\frac{3}{2}x + 3$



- 3(b) $D = [0, \infty), R = [-1, 3] \cup (4, \infty)$
 3(c) $D = [-1, 3] \cup (4, \infty), R = [0, \infty)$
 4. $5b^6 / (8a^{13})$
 5(a) $(3x + 5)(x + 1)$
 5(b) $(5x - 4)(25x^2 + 20x + 16)$
 6(a) $x = 4/3, x = -2/3$
 6(b) $x = 5, x = -4$
 6(c) $x = 69, x = 71$
 7. $\frac{5x^3 + 3x - 5}{x + 1} = 5x^2 - 5x + 8 + \frac{-13}{x + 1}$

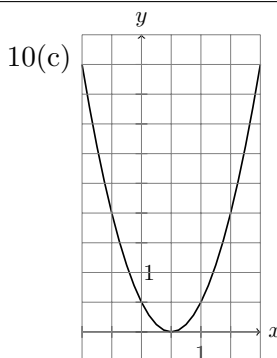
8(a) $h(x) = \frac{x + 3}{x - 5}$

8(b) $g^{-1}(x) = \frac{12}{1 - x}$

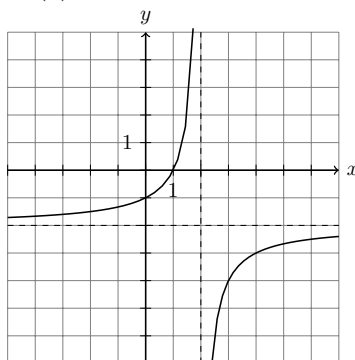
9. $x = -5$

10(a) y -int: $(0, 1/2)$; x -int: $(1/2, 0)$.

10(b) Vertex: $(1/2, 0)$.



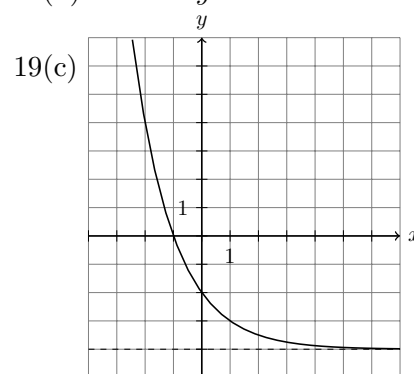
- 11(a). $D = \mathbb{R} \setminus \{0, 1, 16\}$.
 11(b) V.A.'s at $x = 0$ and $x = 16$.
 11(c) H.A. at $y = 0$.
 12(a) y -int: $(0, -1)$. x -int: $(1, 0)$.
 12(b) V.A. at $x = 2$. H.A. at $y = -2$.
 12(c).



13. $3\sqrt{5}$
 14. $-6x^3y^2\sqrt[3]{3y}$
 15. $4\sqrt{2} - 2\sqrt{3}$
 16. $D = (3, 5]$
 17. $x = 2$
 18. \$4,457,842

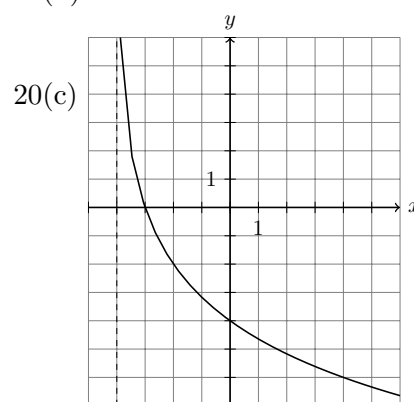
19(a) y -int: $(0, -2)$, x -int: $(-1, 0)$.

19(b) H.A. at $y = -4$. No V.A.



20(a) y -int: $(0, -4)$, x -int $(-3, 0)$.

20(b) V.A. at $x = -4$. No H.A.



21. $\frac{1}{2} \log(2x + 1) - 2x - \frac{8}{3} \log(x - 3)$.

22. $\ln\left(\frac{x}{y^2z^2}\right)$

23. 1.3868

24(a) $x = 0$.

24(b) $x = -14$.

25(a) $2\sqrt{10}/3$

25(b) $-2\sqrt{10}/3$

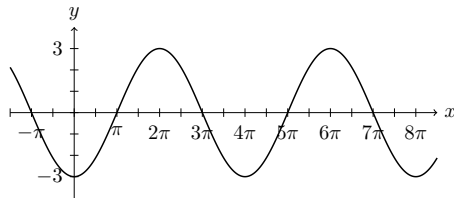
26. -2

27. $\theta = 236.443^\circ$, $\theta = 303.557^\circ$

28. $\theta = 0$, $\theta = \pi$.

29. 3.609m

30. $A = 3$, $P = 4\pi$



31. $a = 4.858$, $C = 20.747^\circ$, $B = 124.253^\circ$

32. 1

$$33. \text{Right Side} = \frac{\frac{1}{\cos x}}{1 + \frac{\sin x}{\cos x}} = \frac{\frac{1}{\cos x}}{1 + \frac{\sin x}{\cos x}} \cdot \frac{\cos x}{\cos x} = \frac{1}{\cos x + \sin x} = \text{Left Side. } \checkmark$$