[2] **1.** Find an equation for the line passing through $(-1, 2)$ and perpendicular to $6 - 3x + 4y = 0$.

[1] **2.** Find an equation of the horizontal line passing through $(-1, 4)$.

[2] **3.** Sketch a graph of the following function: $f(x) = \begin{cases} 1 - 3x & \text{if } x < 1 \\ 2x + 1 & \text{if } x \geqslant 1 \end{cases}$

[3] **4.** Simplify: $\left(\dfrac{3x^2}{y^{-3}}\right)^2 \left(\dfrac{2x^{-3}}{y}\right)^{-2}$. (Your answer should have only positive exponents.)

[6] **5.** Factor each polynomial as much as possible.

(a) $2x^2 - 2x - 84$ (b) $64x^3 - 27$ (c) $3x^3 - 5x^2 - 12x + 20$

[7] **6.** Solve each of the following for x:

(a) $-2(4 - x) < 3 - (2x - 1)$ (b) $5x^2 - 8x + 3 = 0$ (c) $x^3 + 2x^2 - 2x = 0$

[2] **7.** Solve by completing the square: $x^2 - 12x + 3 = 0$

[3] **8.** Perform the long division: $\dfrac{2x^3 - 9x^2 + 7}{2x + 3}$

[3] **9.** Given the quadratic function $f(x) = 9 - (x + 2)^2$,

(a) Find all intercepts. (b) Find the vertex. (c) Sketch a graph of the function.

[6] **10.** Solve each of the following for x:

(a) $\dfrac{x}{x + 24} - \dfrac{2}{x - 8} = \dfrac{-x^2}{(x - 8)(x + 24)}$ (b) $x + 2 + \sqrt{x + 22} = 0$

[9] **11.** Simplify the expressions below. (You may leave factored forms.)

(a) $\dfrac{25 - x^2}{x^2 + 2x - 15} \div \dfrac{x^2 - 10x + 25}{x^{2015} - 3x^{2014}}$ (b) $\dfrac{5}{x^2 + 11x - 26} - \dfrac{3}{x^2 + 17x + 52}$ (c) $\dfrac{\frac{5}{x+2} - \frac{x+2}{5}}{x - 3}$

[2] **12.** Given the rational function $f(x) = \dfrac{3x + 6}{x^2 - 1}$,

(a) Find all vertical asymptotes (if any). (b) Find all horizontal asymptotes (if any). Do **not** sketch.

[4] **13.** Given the rational function $f(x) = \dfrac{3x + 6}{x - 1}$,

(a) Find all intercepts. (b) Find all asymptotes. (c) Sketch a graph of the function.

[5] **14.** Given $f(x) = \dfrac{3x + 5}{x - 2}$ and $g(x) = 5 - 3x$,

(a) Simplify $(f \circ g)(x)$. (b) Find a formula for $f^{-1}(x)$.

[2] **15.** Consider the two points $P(1, -7)$ and $Q(5, 0)$

(a) Find the distance from P to Q. (b) Find the midpoint of the segment joining P and Q.

[2] **16.** Simplify: $5\sqrt{72} - 7\sqrt{50}$

[2] **17.** Reduce the radical expression: $\sqrt[4]{7^6 x^8 y^{17}}$ (You may assume x and y are positive.)

[2] **18.** Rationalize the denominator and simplify: $\dfrac{8}{\sqrt{7} - \sqrt{3}}$

[1] **19.** Convert the following equation to logarithmic form: $5^{-2} = \frac{1}{25}$.

[1] **20.** Harry places \$10,000 in an account that pays 3% interest compounded monthly. How much will be in the account after 4 years? (Give your answer to the nearest dollar.)

[2] **21.** Express as a single logarithm: $3\ln(x) - 2\ln(x+1) - \ln y$.

[3] **22.** Express in terms of the simplest possible logarithms: $\log\left(\dfrac{100\sqrt[3]{x^5}}{(x+6)^{10}}\right)$

[1] **23.** Evaluate $\log_5(1000)$ to three decimal places.

[3] **24.** Solve $64^x = 4 \cdot 8^{x-1}$

[4] **25.** Given the function $y = 2^x - 4$,

(a) Find all intercepts. (b) Find all asymptotes. (c) Sketch a graph of the function.

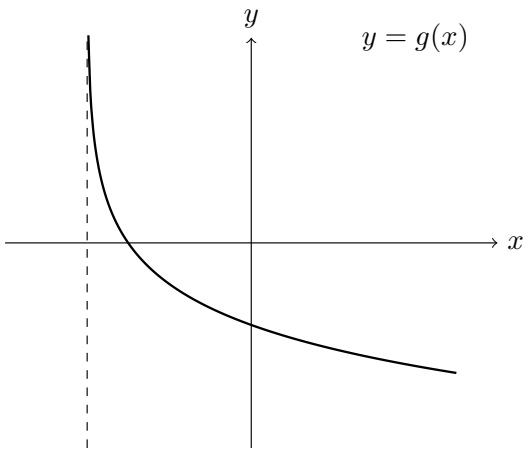
[3] **26.** The graph of a function $y = g(x)$ shown to the right corresponds to one of the formulas below. **Circle the correct formula**, and use it to **find all intercepts and asymptotes**.

(a) $y = -e^x + 2$

(b) $y = -e^{x+2}$

(c) $y = -\ln x + e^2$

(d) $y = -\ln(x + e^2)$



[2] **27.** The terminal side of an angle θ in standard position contains the point $(-1, 6)$. Evaluate all six trig functions of θ. (Give exact values.)

[2] **28.** Find all θ in the inteval $[0°, 360°)$ that satisfy the equation: $\cos\theta = 1/3$. (Give two decimal places.)

[1] **29.** Evaluate $\tan(5\pi/3)$. (Give an exact value.)

[2] **30.** Find all θ in $[0, 2\pi)$ such that $\csc\theta = \sqrt{2}$. (Give exact values.)

[3] **31.** From where you are standing, the top of a building is at an angle of 40°. You walk towards the building and the angle increases to 50°. If the building is 100m tall, how far did you walk? (To the nearest metre.)

[3] **32.** For the function $f(x) = -5\cos(x/2)$,

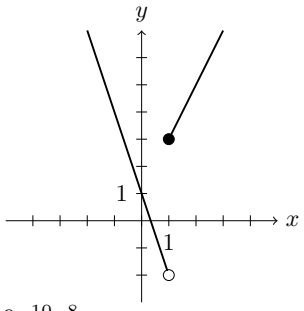
(a) State the amplitude A. (b) State the period P. (c) Sketch a graph. (At least two cycles.)

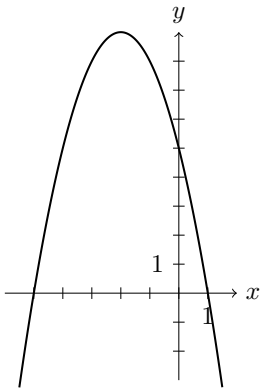
[6] **33.** Prove the identities:

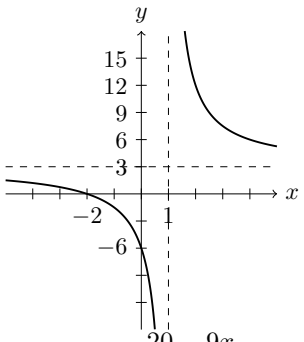
(a) $\dfrac{\csc x}{\csc x - \sin x} = \sec^2 x$ (b) $\tan\theta + \cot\theta = \sec\theta\csc\theta$

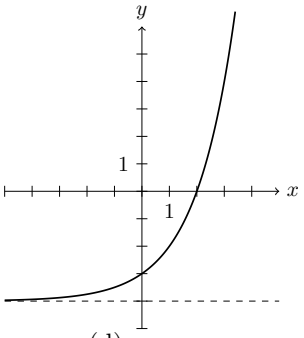
End of Exam. Answers on next page.

ANSWERS

1. $y = -\frac{4}{3}x + \frac{2}{3}$
2. $y = 4$
3. 

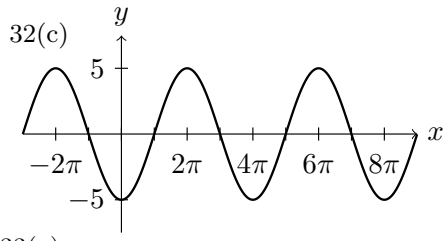
4. $\dfrac{9x^{10}y^8}{4}$
5(a) $2(x-7)(x+6)$
5(b) $(4x-3)(16x^2+12x+9)$
5(c) $(3x-5)(x-2)(x+2)$
6(a) $x < 3$
6(b) $x = 3/5, x = 1$
6(c) $x = 0, x = -1 \pm \sqrt{3}$
7. $x = 6 \pm \sqrt{33}$
8. $x^2 - 6x + 9 - \frac{20}{2x+3}$
9(a) y-int: $(0,5)$; x-int's: $(-5,0)$, $(1,0)$.
9(b) Vertex: $(-2,9)$
9(c) 

10(a) $x = -3$.
10(b) $x = -6$
11(a) $\dfrac{-x^{2014}}{x-5}$
11(b) $\dfrac{2}{(x-2)(x+4)}$
11(c) $\dfrac{-(x+7)}{5(x+2)}$
12(a) $y = 0$
12(b) $x = \pm 1$.
13(a) y-int: $(0,-6)$; x-int: $(-2,0)$.
13(b) V.A. at $x = 1$; H.A. at $y = 3$.
13(c) 

14(a) $(f \circ g)(x) = \dfrac{20 - 9x}{3 - 3x}$
14(b) $f^{-1}(x) = \dfrac{2x+5}{x-3}$
15(a) $\sqrt{65}$
15(b) $(3, -7/2)$
16. $-5\sqrt{2}$
17. $7x^2y^4\sqrt[4]{49y}$
18. $2(\sqrt{7} + \sqrt{3})$
19. $\log_5(1/25) = -2$
20. \$11273
21. $\ln\left(\dfrac{x^3}{y(x+1)^2}\right)$
22. $2 + \frac{5}{3}\log x - 10\log(x+6)$
23. 4.292
24. $x = -1/3$
25(a) y-int: $(0,-3)$; x-int: $(2,0)$.
25(b) H.A. at $y = -4$.
25(c) 

26. Answer=(d).
y-int: $(0,-2)$, x-int: $(1-e^2, 0)$
V.A. at $x = -e^2$.
27.

$\sin\theta = 6/\sqrt{37}$	$\csc\theta = \sqrt{37}/6$
$\cos\theta = -1/\sqrt{37}$	$\sec\theta = -\sqrt{37}$
$\tan\theta = -6$	$\cot\theta = -1/6$

28. $\theta = 70.53°, 289.47°$
29. $-\sqrt{3}$
30. $\pi/4,\ 3\pi/4$
31. 35m
32(a) $A = 5$
32(b) $P = 4\pi$
32(c) 

33(a)
$$\frac{\csc x}{\csc x - \sin x} = \frac{\frac{1}{\sin x}}{\frac{1}{\sin x} - \sin x}$$
$$= \frac{\frac{1}{\sin x}}{\frac{1}{\sin x} - \sin x} \cdot \frac{\sin x}{\sin x}$$
$$= \frac{1}{1 - \sin^2 x} = \frac{1}{\cos^2 x} = \sec^2 x$$

33(b) $\tan\theta + \cot\theta = \dfrac{\cos\theta}{\sin\theta} + \dfrac{\sin\theta}{\cos\theta}$
$$= \frac{\cos\theta}{\sin\theta} \cdot \frac{\cos\theta}{\cos\theta} + \frac{\sin\theta}{\cos\theta} \cdot \frac{\sin\theta}{\sin\theta}$$
$$= \frac{\cos^2\theta + \sin^2\theta}{\cos\theta\sin\theta} = \frac{1}{\cos\theta\sin\theta}$$
$$= \frac{1}{\cos\theta} \cdot \frac{1}{\sin\theta} = \sec\theta\csc\theta.$$