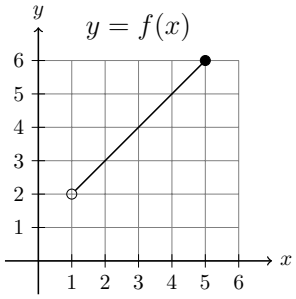
[2] **1.** Consider the two points $A(-1,2)$ and $B(4,-4)$, and let L be the line that passes through A and B.

(a) Find the distance from A to B.

(b) Find an equation for the line L.

[6] **2.** Suppose $y = f(x)$ is given by the following graph:



(a) State the domain and range of f.

(b) Evaluate: $f(f(3))$

(c) Evaluate: $f^{-1}(3)$

(d) Evaluate: $(f^{-1} \circ f)(7/2)$

(e) Sketch a graph of $y = -\frac{1}{2}f(x+2)$.

[3] **3.** Sketch a graph of the function.

$$f(x) = \begin{cases} 1 - 3x & \text{if } x \leqslant 2 \\ x^2 & \text{if } x > 2 \end{cases}$$

[4] **4.** Factor completely.

(a) $6x^2 - 13x + 6$ (b) $x^5 + 64x^2$

5. Solve each of the following for x.

[1] (a) $7 - 4x \leqslant x - 3(x-1)$

[3] (b) $4x^3 - 4x^2 - 9x + 9 = 0$

[4] (c) $\dfrac{-1}{x-3} = \dfrac{10}{x^2+3x} + \dfrac{x-17}{x^2-9}$

[3] (d) $x - \sqrt{7x+30} = 0$

[2] **6.** Solve by completing the square: $x^2 = 200x - 9998$

[3] **7.** Given the quadratic function $f(x) = x^2 + 6x + 10$,
(a) Find all intercepts; (b) Find the vertex; (c) Sketch a graph of the function.

[3] **8.** Use polynomial long division to express $\dfrac{2x^4 - 3x^3 - 7}{x^2 - 2}$ in the form $Q(x) + \dfrac{R(x)}{D(x)}$, where the degree of $R(x)$ is less than the degree of $D(x)$.

9. Let $f(x) = \dfrac{x^2}{x-8}$ and $g(x) = \dfrac{x}{x+1}$.

[1] (a) Simplify $(f/g)(x)$.

[2] (b) Simplify $(f-g)(x)$.

[3] (c) Simplify $g(f(x))$.

[2] (d) Find and simplify $g^{-1}(x)$.

[5] **10.** Given the rational function $R(x) = \dfrac{4x^2 - 4}{x^2 - 4}$,
(a) State the domain of $R(x)$;
(b) Find all intercepts;
(c) Find the equations of all asymptotes;
(d) Sketch a graph of the function.

[3] **11.** Reduce the radical expression $\dfrac{\sqrt[3]{32x^{10}y^7}}{\sqrt[3]{2x^2y^{-2}}}$.

[2] **12.** Simplify $\left(\sqrt{\sqrt[3]{x}\sqrt[5]{x}}\right)^{45}$.

[5] **13.** Let $f(x) = \dfrac{5-\sqrt{x+1}}{24-x}$.
(a) State the domain of f. (b) Rationalize the numerator and simplify $f(x)$.

[2] **14.** An investment pays 4% annually compounded every 6 months. If \$5000 is invested today, what will be the future value 10 years from now? (Answer to the nearest cent.)

[4] **15.** Given the function $g(x) = 3 \cdot (1/3)^x - 9$,
(a) Find all intercepts; (b) Find the equations of all asymptotes; (c) Sketch a graph of the function.

[2] **16.** Express as a single logarithm and simplify: $\log(x^3 - x^2) - 2\log x$

[3] **17.** Express in terms of the simplest possible logarithms: $\ln\left(\dfrac{2^{7x}}{x\sqrt{x^2+x}}\right)$

[2] **18.** Evaluate $\log_5(4^{1000})$ to two decimal places. (Hint: 4^{1000} is too big for your calculator to compute.)

[2] **19.** Suppose the graph of the function $f(x) = \ln(x+b)+c$ has a vertical asymptote at $x = \dfrac{-1}{e}$ and a y-intercept at $(0, 6)$. Find b and c.

[3] **20.** Solve: $\log_2(x-4) = 5 - \log_2 x$

[3] **21.** Solve: $3(5^x) = 2^{(2x+3)}$ (Give a simplified exact value.)

[2] **22.** The terminal side of an angle θ in standard position contains the point $(5, -10)$. Evaluate all six trig functions of θ. (Give simplified exact values.)

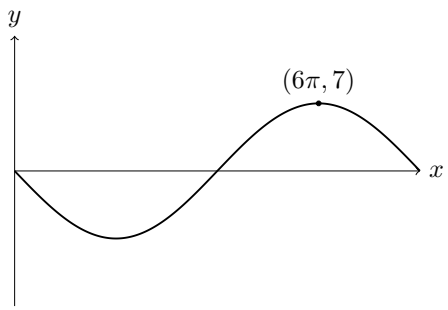
[2] **23.** Find all θ in the interval $[0°, 360°)$ that satisfy the equation: $\sin\theta = 3/5$. (Give two decimal places.)

[2] **24.** Find all θ in $[0, 2\pi)$ such that $\cot\theta = 0$.

[2] **25.** Find all θ in $[0, 2\pi)$ such that $\sec\theta = 2/\sqrt{3}$.

[3] **26.** On a beautiful summer morning, the sun is rising at a rate of 15° per hour. When the sun is 20° above the horizon, the shadow of a flagpole is 30 metres long. How long will the shadow be 2 hours later? (Answer in metres with two decimal places.)

[3] **27.** The graph below is of a function of one of the two forms $y = a\sin(bx)$ or $y = a\cos(bx)$. State which one it is, and find the values of a and b.



[2] **28.** Simplify as much as possible: $\dfrac{\sec x - \cos x}{\sin x}$

[2] **29.** Prove the identity: $\dfrac{\tan x}{\tan x + 1} = \dfrac{1}{\cot x + 1}$

[4] **30.** A triangle has sides of length $a,\ b,\ c$ across from angles of measure $A,\ B,\ C$ respectively. If $a = 10$, $b = 7$ and $c = 6$, find A, B, and C. (Give two decimal places.)

ANSWERS:

1(a) $\sqrt{61}$

1(b) $y = \frac{-6}{5}x + \frac{4}{5}$

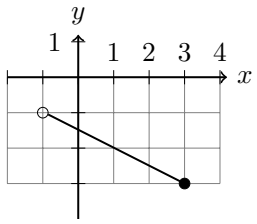
2(a) $D = (1, 5]$, $R = (2, 6]$

2(b) 5

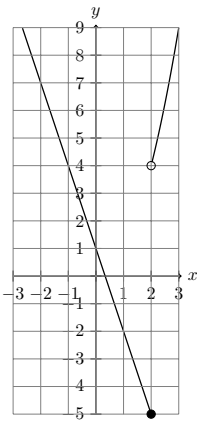
2(c) 2

2(d) 7/2

2(e)



3.



4(a) $(3x - 2)(2x - 3)$

4(b) $x^2(x + 4)(x^2 - 4x + 16)$

5(a) $x \geqslant 2$

5(b) $x = 1, x = \pm 3/2$

5(c) $x = 5$

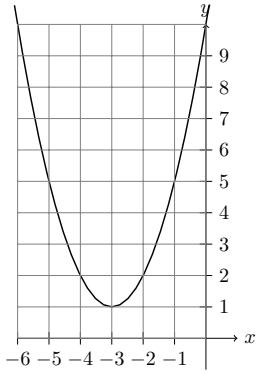
5(d) $x = 10$

6. $x = 100 \pm \sqrt{2}$

7(a) y-int: (0,10);
x-int's: none.

7(b) Vertex: $(-3, 1)$.

7(c)



8. $2x^2 - 3x + 4 + \dfrac{-6x + 1}{x^2 - 2}$

9(a) $\dfrac{x(x+1)}{x-8}$

9(b) $\dfrac{x(x^2+8)}{(x-8)(x+1)}$

9(c) $\dfrac{x^2}{x^2+x-8}$

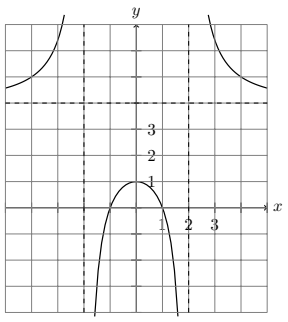
9(d) $\dfrac{-x}{x-1}$

10(a) $D = \mathbb{R}\backslash\{-2, 2\}$

10(b) y-int: $(0, 1)$;
x-int's: $(-1, 0), (1, 0)$.

10(c) H.A. at $y = 4$.
V.A.'s at $x = -2$, $x = 2$.

10(d)



11. $2x^2y^3\sqrt[3]{2x^2}$

12. x^{12}

13(a) $[-1, 24) \cup (24, \infty)$

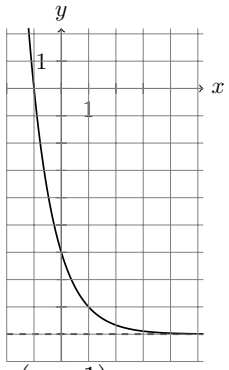
13(b) $f(x) = \dfrac{1}{5 + \sqrt{x+1}}$

14. \$7429.74

15(a) y-int: $(0, -6)$; x-int: $(-1, 0)$

15(b) HA at $y = -9$

15(c)



16. $\log(x - 1)$

17. $7x \ln 2 - \frac{3}{2}\ln x - \frac{1}{2}\ln(x + 1)$

18. 861.35

19. $b = 1/e$, $c = 7$

20. $x = 8$.

21. $x = \dfrac{\ln(\frac{8}{3})}{\ln(\frac{5}{4})}$

22. $\sin\theta = -2/\sqrt{5}$ $\quad \csc\theta = -\sqrt{5}/2$
$\cos\theta = 1/\sqrt{5}$ $\quad \sec\theta = \sqrt{5}$
$\tan\theta = -2$ $\quad \cot\theta = -1/2$

23. $\theta = 36.87°, 143.13°$

24. $\theta = \pi/2, 3\pi/2$

25. $\theta = \pi/6, 11\pi/6$

26. 9.16m

27. $y = -7\sin\left(\frac{x}{4}\right)$. (i.e. $a = -7, b = 1/4$.)

28. $\tan x$

29. Right Side$= \dfrac{1}{\frac{1}{\tan x} + 1} \cdot \frac{\tan x}{\tan x}$ =Left Side.

30. $A \approx 100.29°, B \approx 43.53°, C \approx 36.18°$.