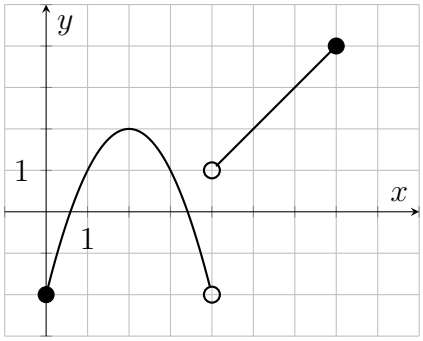
Multiple choice

For each of the following questions, there is only one correct answer. Circle your choice. If two choices are selected for the same question, no marks will be awarded.

1. Consider the graph of the function f, shown below.



(a) (1 point) What is the domain of f?

A. $[0, 7]$ B. $[-2, 4]$ C. $[0, 4) \cup (4, 7]$ D. $(-2, 4]$

(b) (1 point) What is the range of f?

A. $[0, 7]$ B. $[-2, 4]$ C. $[0, 4) \cup (4, 7]$ D. $(-2, 4]$

(c) (1 point) Evaluate $f(3)$.

A. 0 B. 1 C. 6 D. Undefined.

(d) (1 point) Evaluate $(f \circ f)(7)$.

A. –2 B. 1 C. 16 D. Undefined.

(e) (1 point) How many solution(s) does the equation $f(x) = 0$ have?

A. 0 B. 1 C. 2 D. 3

(f) (1 point) Is the function f invertible?

A. Yes B. No

2. (1 point) If $g(x) = \dfrac{1}{1-3x}$, then $g(x+h)$ is

A. $\dfrac{1}{1-3x} + h$ B. $\dfrac{1}{1-3x+h}$ C. $\dfrac{1}{1-3x+3h}$ D. $\dfrac{1}{1-3(x+h)}$

3. (1 point) Let $f(x) = \dfrac{(x-1)(x+3)}{(x+1)(2-x)}$. The domain of f is:

A. $\{-1, 2\}$ B. $\mathbb{R}\backslash\{-1, 2\}$ C. $\{-3, -1, 1, 2\}$ D. $\mathbb{R}\backslash\{-3, -1, 1, 2\}$

4. (1 point) For two non-zero vectors $\vec{u}$ and $\vec{v}$, if $\vec{u} \cdot \vec{v} = \vec{0}$, then we know that:

A. $\vec{u}$ and $\vec{v}$ are parallel.

B. $\vec{u}$ and $\vec{v}$ are perpendicular.

C. $\vec{u}$ and $\vec{v}$ have the same length.

D. None of the above.

5. (1 point) If $\log x = \log y + 3 \log z$, then

A. $x = y + 3z$

B. $x = y + z^3$

C. $x = yz^3$

D. $x = (yz)^3$

6. (1 point) Consider the function $f(x) = \left(\dfrac{1}{3}\right)^x$. As x becomes larger, the value of $f(x)$ will

A. get larger as well.

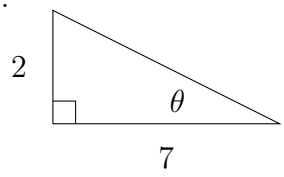
B. get closer to zero.

C. become negative.

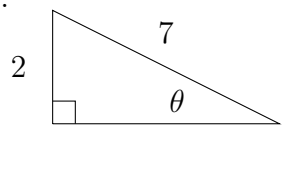
D. None of the above.

7. (1 point) If $\sec\theta = \dfrac{7}{2}$. Choose the triangle that correctly represents this situation:

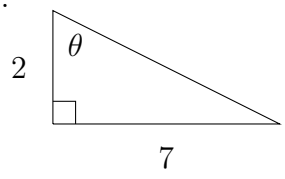
A. .



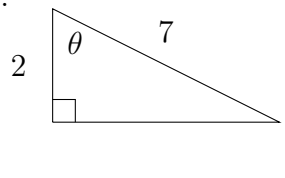
C. .



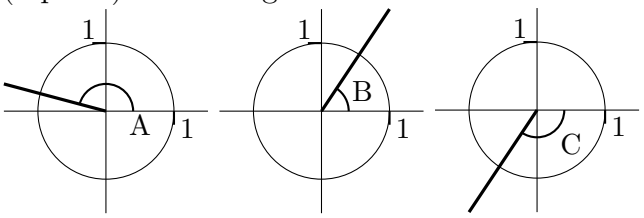
B. .



D. .



8. (1 point) Three angles are shown below. Order the values of $\sin A$, $\sin B$, and $\sin C$ in increasing order.



A. $\sin A < \sin B < \sin C$

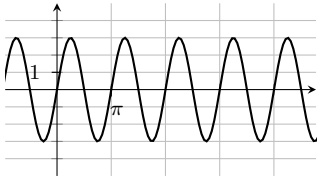
B. $\sin C < \sin B < \sin A$

C. $\sin B < \sin A < \sin C$

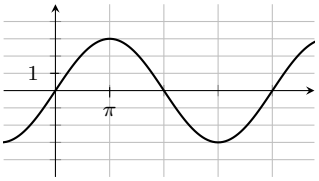
D. $\sin C < \sin A < \sin B$

9. (1 point) Which one of the following graphs corresponds to the function $f(x) = 3\sin(2x)$.

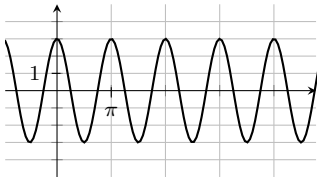
A.



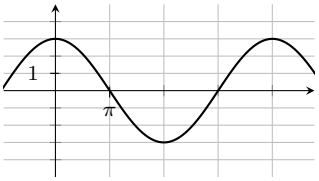
C.



B.



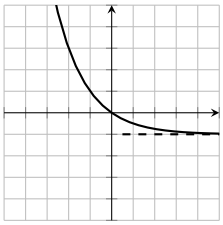
D.



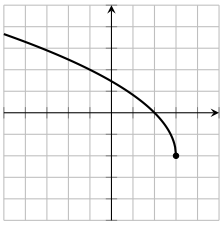
Short Answer

10. Consider the following four graphs.

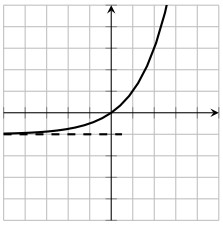
A. .



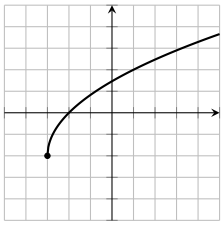
B. .



C. .



D. .



(a) (2 points) The graph of the curve $y = 2\sqrt{3-x} - 2$ is _____.

(b) (2 points) The graph of the curve $y = 2^{-x} - 1$ is _____.

11. (4 points) Determine if the following statements are true or false for all values of x in the domain of both sides. Answer "**True**" or "**False**".

(a) $\sqrt{x^2+3} = x + \sqrt{3}$ _____

(b) $\dfrac{x}{x^2+3} = \dfrac{1}{x+3}$ _____

(c) $\ln(x+3) = \ln x + \ln 3$ _____

(d) $2^{x+3} = 2^x 2^3$ _____

12. (2 points) The simplified form of $(\sqrt{x})(\sqrt[3]{x^2})$ is _____.

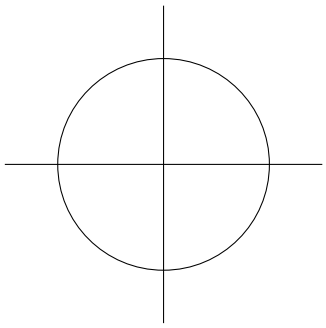
13. (2 points) If $\sqrt{3x-2} = 5$, then $x =$_____.

14. (2 points) The solution of the equation $\log_2 x = 5$ is _____.

15. (2 points) The value of $\log_5(25^{2019})$ is _____.

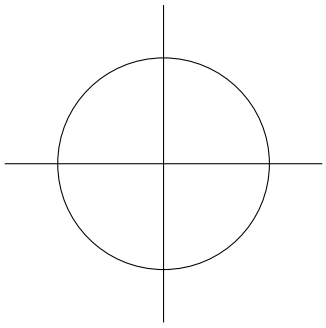
16. (2 points) The radian measure of the angle $-330°$ is _____.

17. (2 points) Sketch the angle $\frac{-3\pi}{4}$ in the following graph.



18. (2 points) The exact value of $\sin\left(\frac{-3\pi}{4}\right)$ is _____.

19. (2 points) Sketch the angle(s) $\theta \in [0, 360°)$ that satisfy the equation $\cos(\theta) = \frac{-1}{3}$.



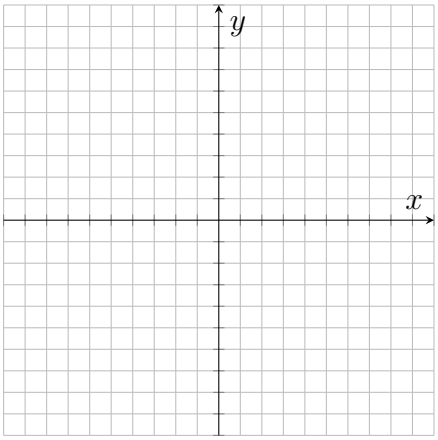
20. (3 points) Solve the equation $\cos(\theta) = \frac{-1}{3}$.

Long Answer

21. (a) (2 points) Find the x and y intercepts of the function $g(x) = \frac{1}{2}(x^2 - 4x - 5)$.

(b) (2 points) Find the vertex of the graph of g by completing the square.

(c) (2 points) Sketch the graph of the function g.



22. (2 points) Factor $2x^3 - 3x^2 - 8x + 12$ completely.

23. (2 points) Factor $27x^3 + 8$ completely.

24. (3 points) Add and simplify $\dfrac{x}{x^2 - 4} + \dfrac{3}{5x - 10}$.

25. (3 points) Find the inverse of the function $f(x) = \dfrac{x}{3 - 2x}$.

26. (3 points) Simplify the expression $\dfrac{\frac{x}{2} - \frac{2}{x}}{x - 2}$.

27. (4 points) Solve the following inequality: $\dfrac{x^2 + 2x - 3}{x - 4x^2} \geqslant 0$.

28. (a) (2 points) Solve the equation $4u^2 - 9u + 2 = 0$.

(b) (2 points) Now, solve $4x^4 - 9x^2 + 2 = 0$.

(c) (2 points) Solve the equation $4 \cdot e^{2x} - 9 \cdot e^x + 2 = 0$.

29. Let $h(x) = 3\log_2(x + 4) - 9$.

(a) (2 points) Find the x and y intercepts of the graph of h.

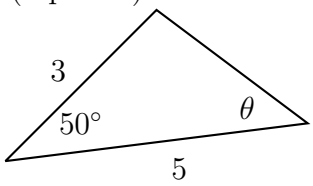
(b) (2 points) Does the graph of h have any asymptotes? If so, find their equation.

(c) (2 points) Sketch the graph of the function h.

30. (a) (2 points) Factor the polynomial $9x^2 - 3x - 2$ completely.

(b) (4 points) Solve the following equation: $\log_2(3x + 4) + \log_2(3x - 1) = 1 + \log_2(6x - 1)$.

31. (3 points) In the triangle below, find the value of θ.



32. (3 points) Rob constructed a play house for his daughter using 27m^3 of cardboard that is 4m high. He would like to construct a **similar** house using 22m^3 of cardboard. How high will the new house be?

Applications

33. (4 points) A model airplane is launched from a bridge into a river below. The height of the airplane above the river can be represented by the equation $h(t) = -t^2 + 4t + 5$, where h is the height of the airplane in meters and t is the time in seconds after the airplane is launched.

(a) What is the height of the model airplane above the river at the time of the launch?

(b) What is the maximum height above the water reached by the model airplane?

(c) How many seconds after the launch will the model airplane touch the river?

34. (4 points) Luke invests \$2500 at an annual nominal rate of 7%, compounded monthly.

(a) What will be the value of his investment two years later?

(b) If he wants to buy a lightsaber at \$4000, how long will he have to wait before he can buy it?

35. (4 points) Cath is standing on the side of a road that is 7m wide, and is looking directly across. Moreover, if she turns her head 21° degrees to the left, she sees a deer on the other side of the road; if she then moves her head 13° further, she sees a road sign.

(a) Sketch the situation.

(b) How far apart are the deer and the road sign?