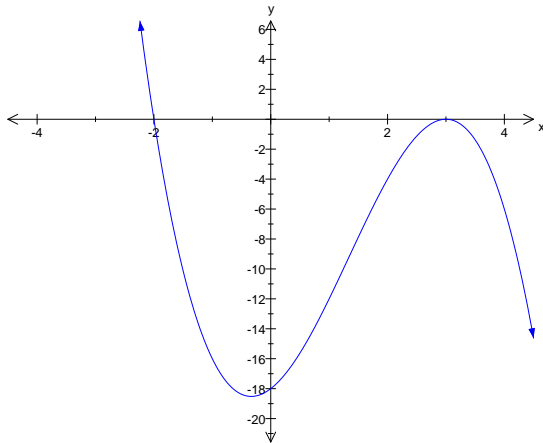


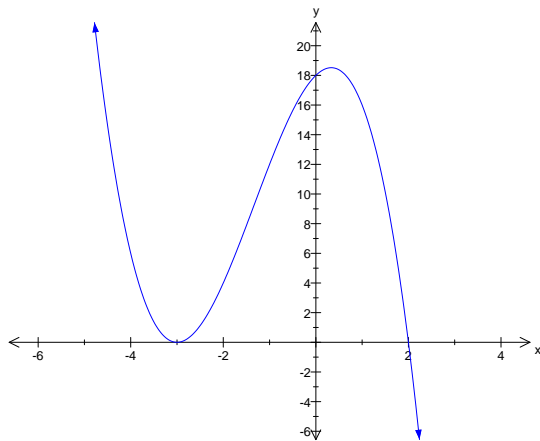
Part 1: Selected Response

1. Which is the graph of a polynomial function that has a root of multiplicity 2 at $x = -3$, a root of multiplicity 1 at $x = 2$ and a negative leading coefficient?

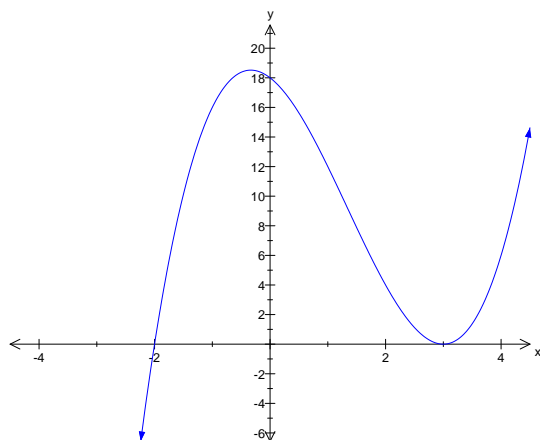
A)



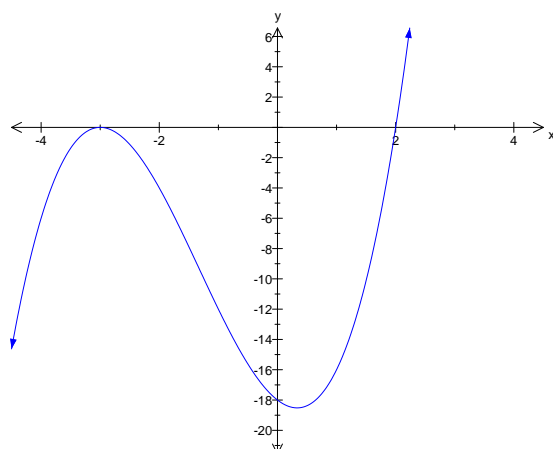
B)



C)



D)



2. Which is a polynomial function?

A) $y = -2x^2 - \frac{1}{x}$

B) $y = x^2 + x^{-1}$

C) $y = 4x^2 + x$

D) $y = 5x^2 - \sqrt{x}$

3. What are the zeroes of the polynomial function $y = -2x^3 + 6x^2 + x - 3$?

A) $\left\{-3, \pm \frac{\sqrt{2}}{2}\right\}$

B) $\left\{-3, \pm \frac{1}{2}\right\}$

C) $\left\{3, \pm \frac{\sqrt{2}}{2}\right\}$

D) $\left\{3, \pm \frac{1}{2}\right\}$

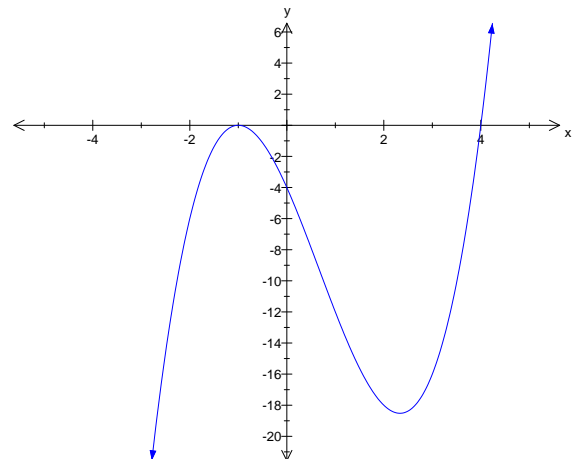
4. Which is the equation of the polynomial function represented by the following graph?

A) $y = -(x + 1)^2(x - 4)$

B) $y = -(x - 1)^2(x + 4)$

C) $y = (x + 1)^2(x - 4)$

D) $y = (x - 1)^2(x + 4)$



5. What is the remainder when $2x^3 - 5x + 6$ is divided by $x + 2$?

A) 0

B) 4

C) 12

D) 24

6. Which is a factor of the polynomial $x^3 - 4x^2 + x + 6$?

A) -3

B) -2

C) 1

D) 3

7. Which best describes the transformations applied to the function $y = f(x)$ to give the function $y = f(4x) - 5$?

A) Horizontally stretched by a factor of $\frac{1}{4}$ and vertically transformed 5 units up.

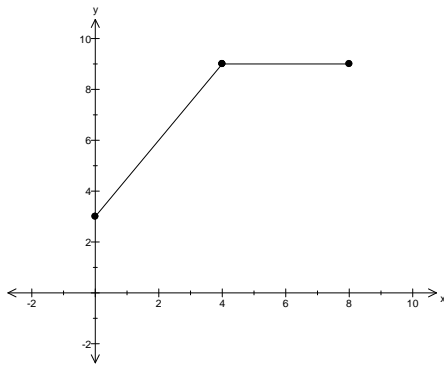
B) Horizontally stretched by a factor of $\frac{1}{4}$ and vertically transformed 5 units down.

C) Horizontally stretched by a factor of 4 and vertically transformed 5 units up.

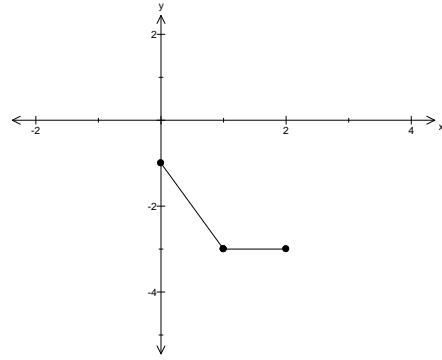
D) Horizontally stretched by a factor of 4 and vertically transformed 5 units down.

8. Which function represents the transformed function of $y = f(x)$ in the graphs below?

$$y = f(x)$$



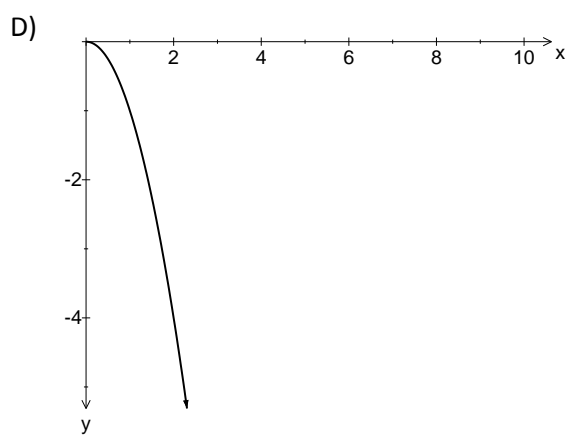
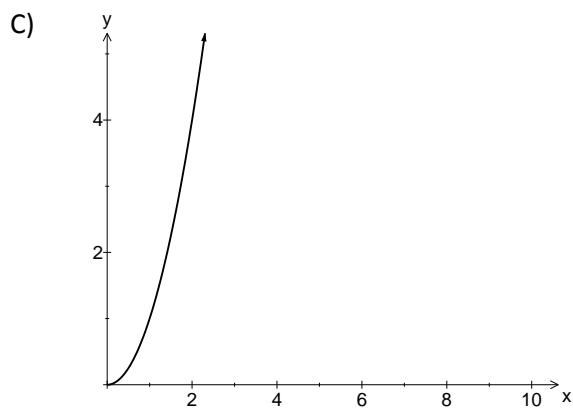
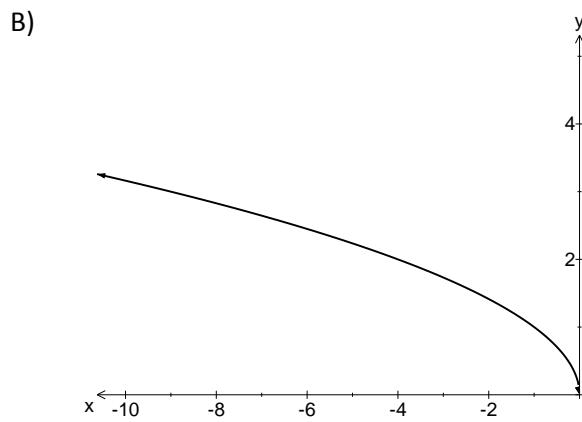
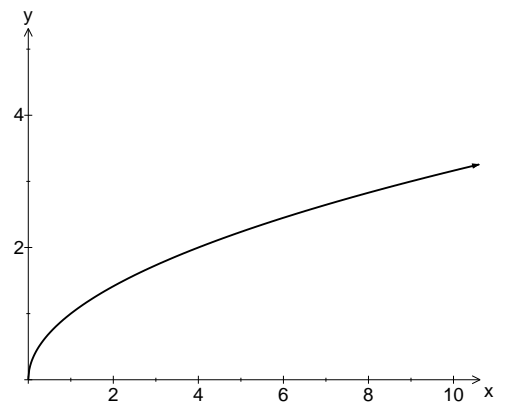
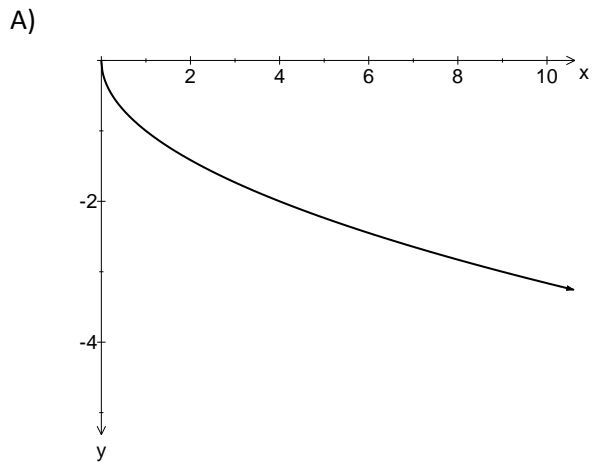
$$y = af\left(\frac{1}{b}x\right) + k$$



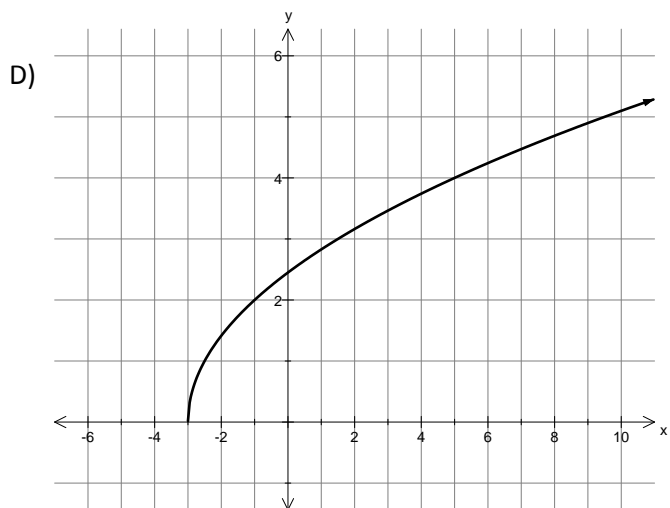
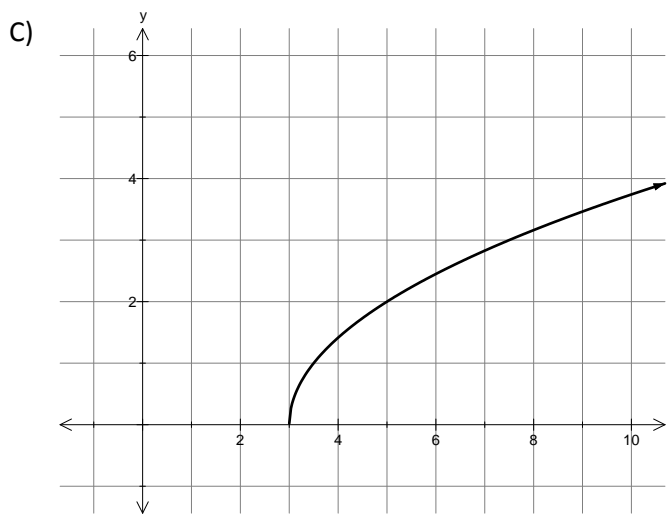
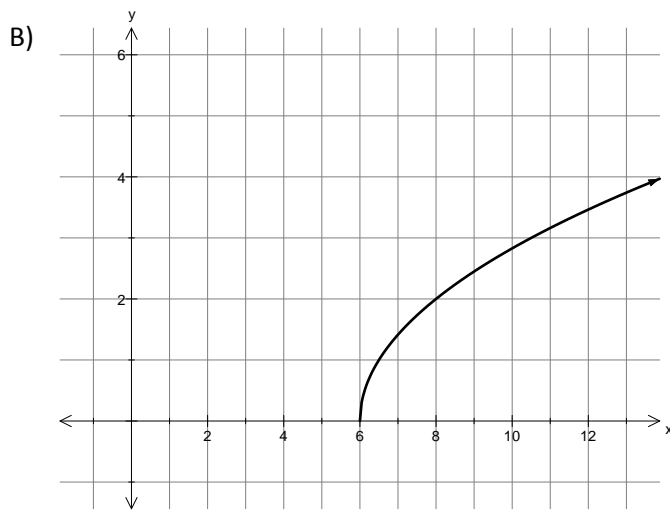
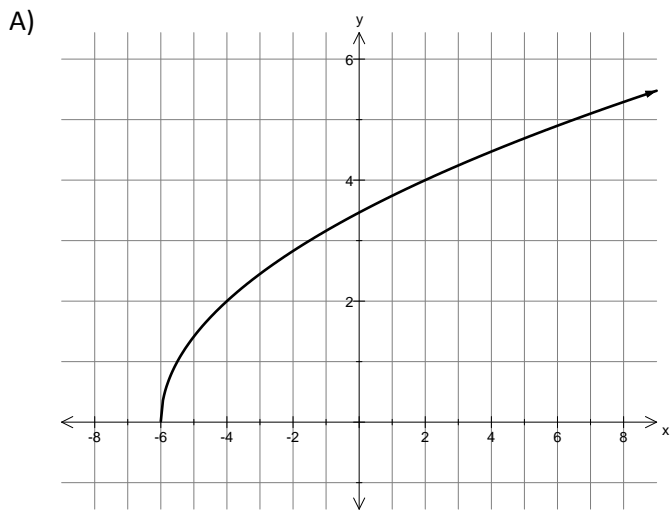
- A) $y = -3f\left(\frac{1}{4}x\right)$
- B) $y = -\frac{1}{3}f(4x)$
- C) $y = \frac{1}{3}f(-4x)$
- D) $y = 3f\left(-\frac{1}{4}x\right)$
9. The graph of $y = f(x + 1) - 1$ has been vertically translated 2 units down, horizontally translated 6 units to the right. Which function represents the transformed graph?
- A) $y = f(x - 5) - 3$
- B) $y = f(x - 5) + 1$
- C) $y = f(x + 7) - 3$
- D) $y = f(x + 7) + 1$
10. The function $y = f(x)$ has been transformed such that $y = -\frac{1}{2}f(2x - 4) + 3$. What are the coordinates of the image point of $(-2, 4)$?
- A) $(1, -5)$
- B) $(1, 1)$
- C) $(3, -5)$
- D) $(3, 1)$
11. Given the equation $y = f\left(\frac{1}{2}x + 4\right)$ is an image of $f(x)$, what is the mapping?
- A) $(x, y) \rightarrow \left(\frac{1}{2}x - 8, y\right)$
- B) $(x, y) \rightarrow \left(\frac{1}{2}x - 4, y\right)$
- C) $(x, y) \rightarrow (2x - 4, y)$
- D) $(x, y) \rightarrow (2x - 8, y)$

12. Which graph is the inverse of $y = f(x)$?

$y = f(x)$



13. Which is the graph of $y = \sqrt{2x - 6}$?



14. Given $f(x) = 2x - 5$, what are the invariant points of $f(x)$ and $\sqrt{f(x)}$?

A) $(-3, 1), \left(-\frac{5}{2}, 0\right)$

B) $(-3, 1), \left(\frac{5}{2}, 0\right)$

C) $\left(-\frac{5}{2}, 0\right), (3, 1)$

D) $\left(\frac{5}{2}, 0\right), (3, 1)$

15. What is the domain of the function $y = -\sqrt{x+3}$?

A) $\{x|x \leq -3, x \in R\}$

B) $\{x|x \geq -3, x \in R\}$

C) $\{x|x \leq 3, x \in R\}$

D) $\{x|x \geq 3, x \in R\}$

16. What is -240° in radian measure?

A) $-\frac{4\pi}{3}$

B) $-\frac{2\pi}{3}$

C) $\frac{2\pi}{3}$

D) $\frac{4\pi}{3}$

17. Which is the equation of a circle centered at the origin with diameter 12?

A) $x^2 + y^2 = 6$

B) $x^2 + y^2 = 12$

C) $x^2 + y^2 = 36$

D) $x^2 + y^2 = 144$

18. What is the exact value of the trigonometric expression $\frac{\sin\frac{\pi}{4}}{\cot\frac{\pi}{6}}$?

A) $\frac{\sqrt{3}}{6}$

B) $\frac{\sqrt{3}}{2}$

C) $\frac{\sqrt{6}}{2}$

D) $\frac{\sqrt{6}}{6}$

19. Solve for x : $\sqrt{2} \csc x + 2 = 0$; for $0 \leq x \leq 2\pi$.

A) $\left\{-\frac{\pi}{4}, \frac{3\pi}{4}\right\}$

B) $\left\{-\frac{\pi}{4}, \frac{5\pi}{4}\right\}$

C) $\left\{\frac{\pi}{4}, \frac{3\pi}{4}\right\}$

D) $\left\{\frac{5\pi}{4}, \frac{7\pi}{4}\right\}$

20. Given $\cos \theta = -\frac{5}{13}$ where $\pi \leq \theta \leq \frac{3\pi}{2}$, what is the value of $\csc \theta$?

A) $-\frac{13}{12}$

B) $-\frac{5}{12}$

C) $\frac{5}{12}$

D) $\frac{13}{12}$

21. Which step contains the first error in solving the trigonometric equation $5 + 4 \cos x - 1 = 0$ for $0^\circ \leq x \leq 360^\circ$?

$$5 + 4 \cos x - 1 = 0$$

Step 1: $4 + 4 \cos x = 0$

Step 2: $4 \cos x = 4$

Step 3: $\cos x = 1$

Step 4: $x = 0^\circ$

A) Step 1

B) Step 2

C) Step 3

D) Step 4

22. What is the horizontal translation of the trigonometric function $y = -2 \cos(3x - 30^\circ)$?

A) -30°

B) -10°

C) 10°

D) 30°

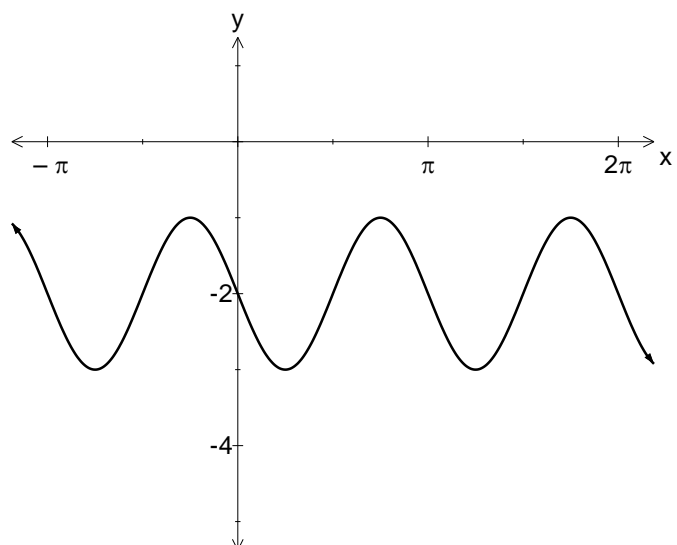
23. What is the period of the trigonometric function represented by the graph below?

A) π

B) 2π

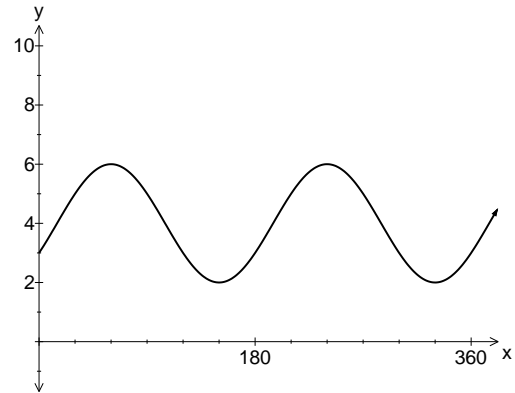
C) 3π

D) 4π



24. Which trigonometric function is represented by the graph below?

- A) $y = 2 \cos(2(x - 60)) - 4$
 B) $y = 2 \cos(2(x - 60)) + 4$
 C) $y = 2 \cos(2(x + 60)) - 4$
 D) $y = 2 \cos(2(x + 60)) + 4$

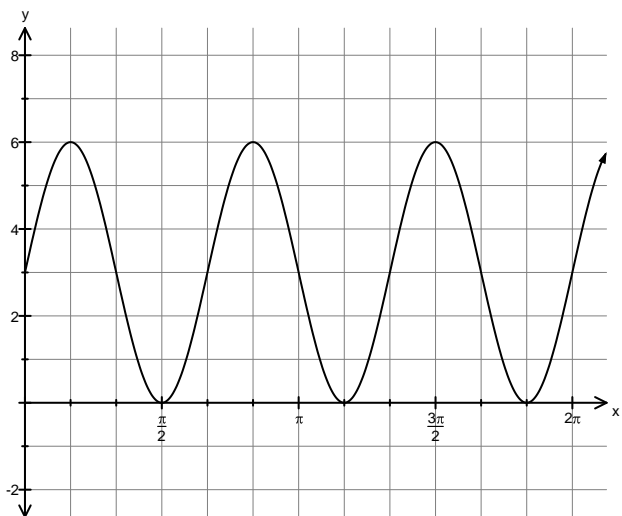


25. Which sinusoidal function has a period of $\frac{2\pi}{3}$, and amplitude of 2?

- A) $y = \frac{1}{2} \sin\left(\frac{1}{3}x\right)$
 B) $y = \frac{1}{2} \sin(3x)$
 C) $y = 2 \sin\left(\frac{1}{3}x\right)$
 D) $y = 2 \sin(3x)$

26. Given the graph of $y = 3 \cos\left(3\left(x - \frac{\pi}{6}\right)\right) + 3$, what are the solutions to the equation $3 \cos\left(3\left(x - \frac{\pi}{6}\right)\right) + 3 = 3$?

- A) $x = \frac{\pi}{2}k, k \in I$
 B) $x = \frac{\pi}{3}k, k \in I$
 C) $x = \frac{\pi}{4}k, k \in I$
 D) $x = \frac{\pi}{6}k, k \in I$



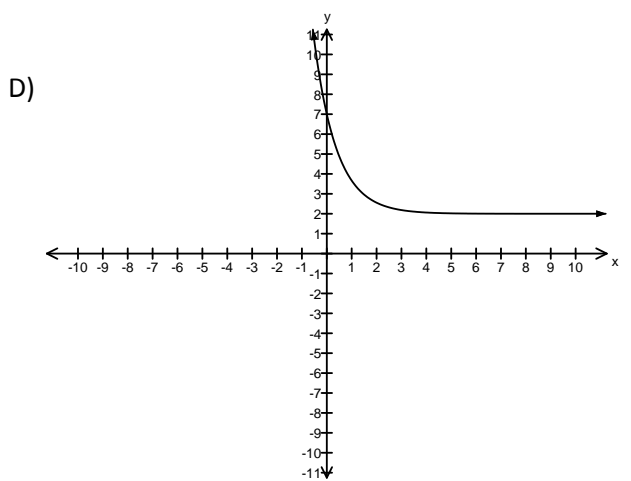
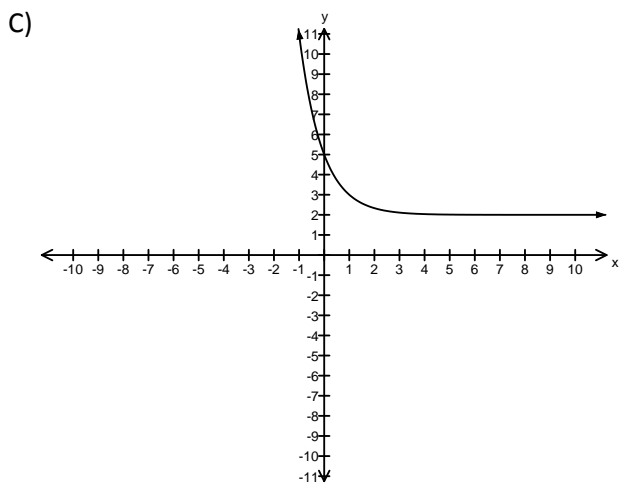
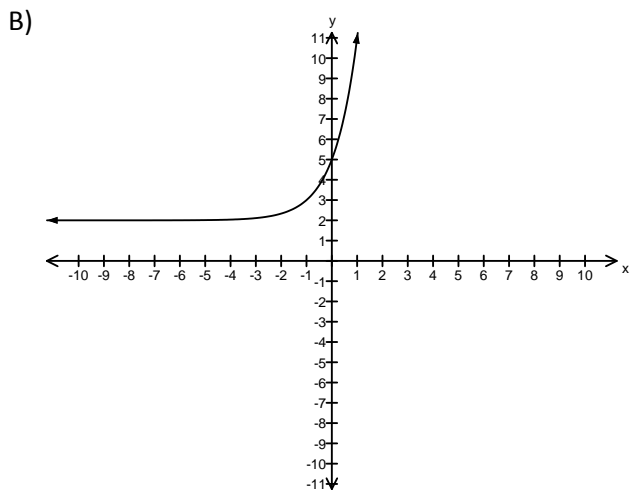
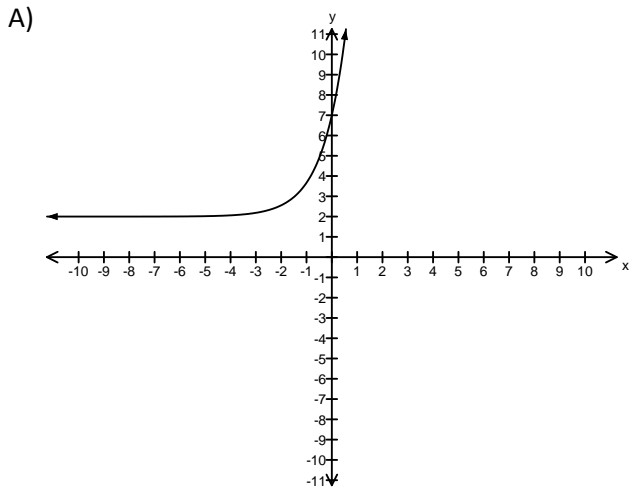
27. What are the non-permissible values of x for the equation $\csc x + \cos x = \cot x$?

- A) $x \neq \frac{\pi}{2}n, n \in I$
 B) $x \neq \pi n, n \in I$
 C) $x \neq \frac{\pi}{2} + \frac{\pi}{2}n, n \in I$
 D) $x \neq \frac{\pi}{2} + \pi n, n \in I$

28. Which expression should be used to calculate $\cos 75^\circ$?
- A) $\sin 45^\circ \cos 30^\circ + \cos 45^\circ \sin 30^\circ$
- B) $\sin 45^\circ \cos 30^\circ - \cos 45^\circ \sin 30^\circ$
- C) $\cos 45^\circ \cos 30^\circ + \sin 45^\circ \sin 30^\circ$
- D) $\cos 45^\circ \cos 30^\circ - \sin 45^\circ \sin 30^\circ$
29. What is $\cos^2\left(\frac{\pi}{2}\right) - \sin^2\left(\frac{\pi}{2}\right)$ expressed as a single trigonometric expression?
- A) $\cos\left(\frac{\pi}{4}\right)$
- B) $\cos\left(\frac{\pi}{2}\right)$
- C) $\cos(\pi)$
- D) $\cos(2\pi)$
30. What is $\frac{\tan(x) - \tan(x)\cos^2(x)}{\sin^3(x)}$ expressed as a single trigonometric expression?
- A) $\cot x$
- B) $\csc x$
- C) $\sec x$
- D) $\tan x$
31. What is the exact value of $\sin(15^\circ)$?
- A) $\frac{\sqrt{2}-\sqrt{6}}{2}$
- B) $\frac{\sqrt{2}-\sqrt{6}}{4}$
- C) $\frac{\sqrt{6}-\sqrt{2}}{2}$
- D) $\frac{\sqrt{6}-\sqrt{2}}{4}$
32. Given $\sin \theta = -\frac{3}{5}$ and $\frac{3\pi}{2} \leq \theta \leq 2\pi$, what is the exact value of $\sin 2\theta$?
- A) $-\frac{24}{5}$
- B) $-\frac{24}{25}$
- C) $\frac{24}{5}$
- D) $\frac{24}{25}$

33. What are the solutions of $\cos 2x + \sin^2 x = \frac{1}{2}$, $0 \leq \theta \leq 2\pi$?
- A) $\frac{\pi}{4}, \frac{7\pi}{4}$
- B) $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$
- C) $\frac{\pi}{6}, \frac{5\pi}{6}$
- D) $\frac{\pi}{3}, \frac{5\pi}{3}$
34. What is the range of the function $y = -2 \cdot 5^x + 3$?
- A) $\{y|y < -3, y \in R\}$
- B) $\{y|y > -3, y \in R\}$
- C) $\{y|y < 3, y \in R\}$
- D) $\{y|y > 3, y \in R\}$
35. What is the equation of the horizontal asymptote for $y = 6 \cdot 2^{x+3} - 4$?
- A) $y = -4$
- B) $y = -3$
- C) $y = 3$
- D) $y = 4$
36. Solve for x: $\left(\frac{1}{2}\right)^x = 8^{x+1}$
- A) $x = -\frac{3}{4}$
- B) $x = -\frac{1}{4}$
- C) $x = \frac{3}{4}$
- D) $x = \frac{3}{2}$
37. A car's original value was \$25000. It depreciates, annually, at a rate of 18%. Which function models this situation?
- A) $V = 25000(0.18)^t$
- B) $V = 25000(0.82)^t$
- C) $V = 25000(1.18)^t$
- D) $V = 25000(1.82)^t$

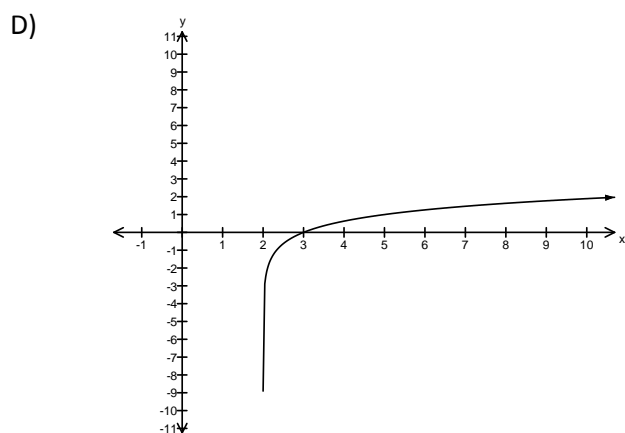
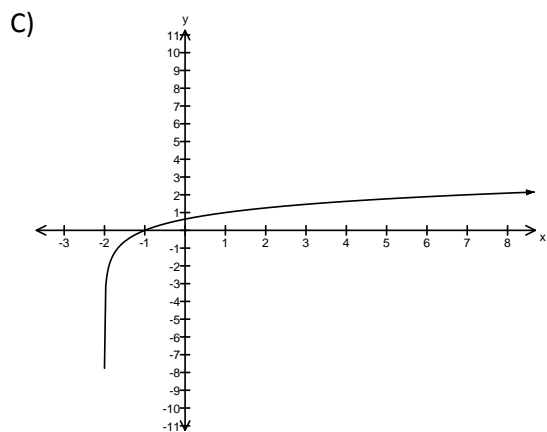
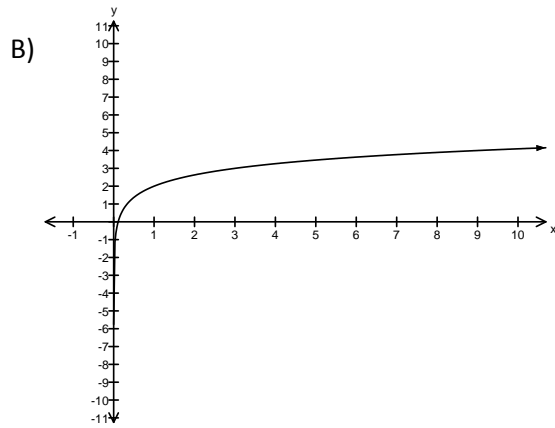
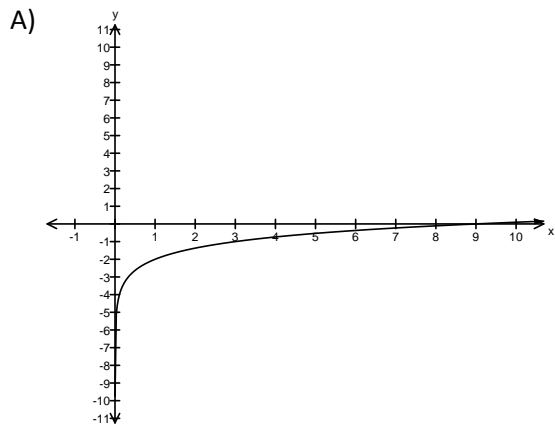
38. Which is the graph of $y = 5 \cdot 3^x + 2$?



39. What is the domain of the function $y = 3 \log(x - 2) + 5$?

- A) $\{x|x > -5\}$
- B) $\{x|x > -2\}$
- C) $\{x|x > 2\}$
- D) $\{x|x > 5\}$

40. Which is the graph of $y = \log_3(x) - 2$?

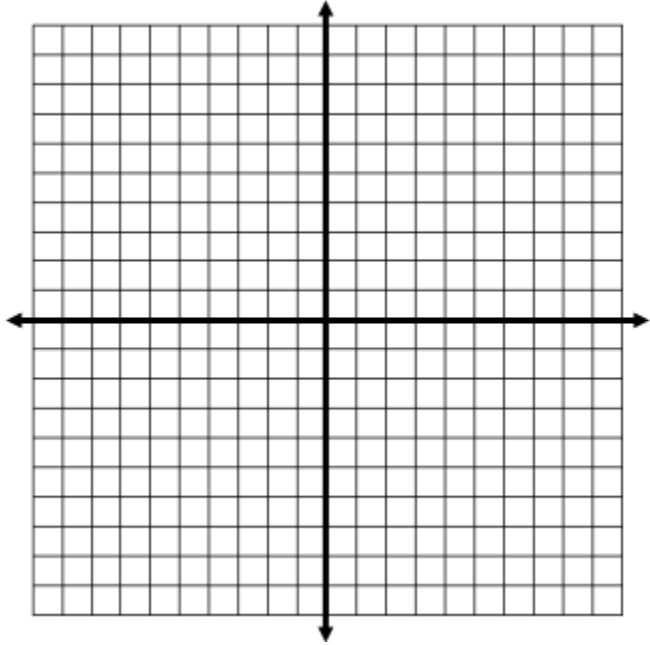


41. Simplify: $\log_4 20 + \log_4 32 - \log_4 10$
- A) $\log_4 42$
B) 3
C) $\log_4 42$
D) 64
42. Solve: $\log_3 2x - \log_3 4 = 3$
- A) $\frac{3}{8}$
B) $\frac{27}{8}$
C) 6
D) 54
43. Solve: $6^x - 3 = 20$
- A) $\frac{\log 6}{\log 17}$
B) $\frac{\log 6}{\log 23}$
C) $\frac{\log 17}{\log 6}$
D) $\frac{\log 23}{\log 6}$
44. A club contains 21 people, 8 of which are boys. In how many ways can a committee of 4 people be selected such that there are two boys and two girls on the committee?
- A) ${}_8P_2 \times {}_{13}P_2$
B) ${}_8C_2 \times {}_{13}C_2$
C) ${}_{21}P_4$
D) ${}_{21}C_4$
45. Which is equivalent to ${}_{11}C_3$?
- A) ${}_{11}P_3$
B) ${}_{11}P_8$
C) ${}_{11}C_8$
D) ${}_3C_{11}$

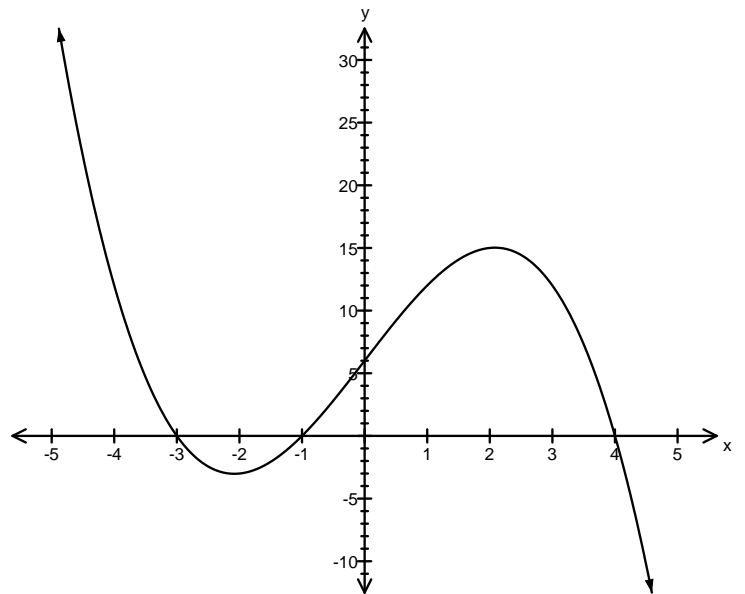
46. What is the coefficient of x^5y^3 in the expansion of $(x + y)^8$?
- A) 8
 - B) 28
 - C) 56
 - D) 70
47. In how many ways can you arrange 10 students in a line if Kaitlyn, Isabella and Brittany must be together?
- A) 30240
 - B) 40320
 - C) 241920
 - D) 3628800
48. The student council has four positions (President, Vice-President, Secretary and Treasurer). There are a group of 10 students who wish to be on the student council. How many different councils can be created from the 10 students?
- A) 24
 - B) 210
 - C) 5040
 - D) 3628800
49. What is the third term in the expansion of $(2x + 3)^6$?
- A) $64x^4$
 - B) $720x^4$
 - C) $2160x^4$
 - D) $4320x^4$
50. Sean and Krista are planning the meal for their wedding. The possible menu choices have four appetizers, two main courses and three desserts to choose from. How many different meals can they select if each meal contains one appetizer, one main course and one dessert?
- A) 9
 - B) 10
 - C) 24
 - D) 36

Part 2: Constructed Response

- {4} 51A. Given the function $y = 2x^3 - 4x^2 - 13x + 6$, identify the x and y intercepts then graph the function.

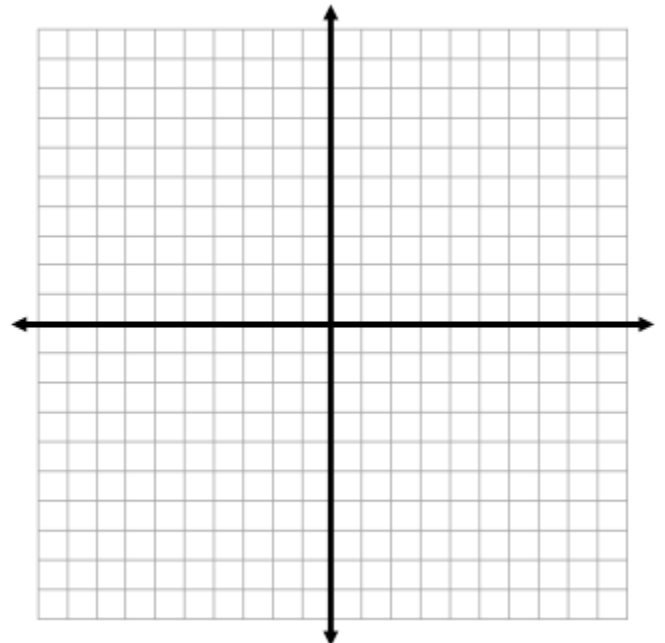


- {2} 51B. Steve attempted to determine the equation of the function in the graph. He concluded the equation was $y = (x + 3)(x - 4)(x + 1)$. What mistake(s) did Steve make?

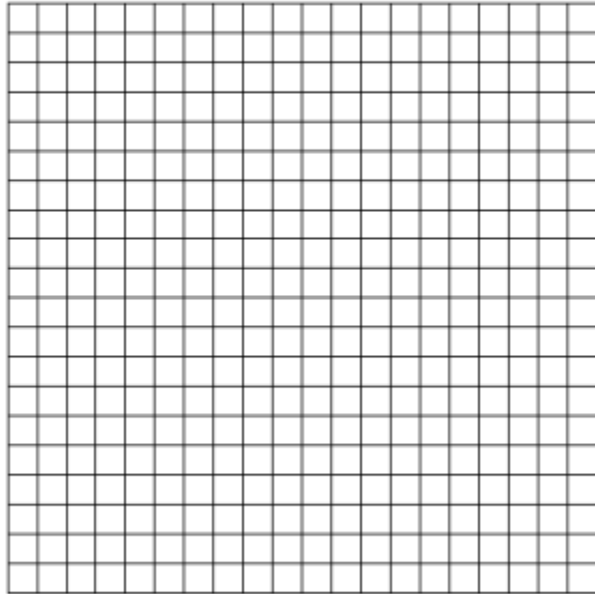


- {3} 52. Given the function $y = 2(x + 1)^2 - 3$, Restrict the domain of a given function in order for its inverse to be a function and then find the inverse.

- {2} 53A Determine, graphically, the solution of $x + 3 = \sqrt{18 - 2x^2}$.



{2} 53B Graph $y = \frac{1}{2}\sqrt{-2(x-4)} - 3$.



{2} 53C Determine the domain and range of the function $y = -\sqrt{-(x-1)} + 4$

{3} 54 Algebraically determine the solutions of $2 \cos^2 \theta - \cos \theta - 1 = 0$; $0 \leq \theta \leq \pi$.

{3} 55A The average number of skateboards sold in Canada varies seasonally and depends on the month of the year. The formula $y = 4.8 + 1.7 \sin\left(\frac{\pi}{6}(t - 2)\right)$ gives the expected sales, y , in thousands, according to the month, t , where $t = 1$ represents January, $t = 2$ represents February and so on. In what month are sales of 6500 skateboards expected?

{4} 55B Algebraically determine the solutions to $(\sqrt{2} \sec x - 2)(\tan x + 1) = 0$.
Identify the restrictions on the variable.

{4} 56A $\angle A$ and $\angle B$ are both in Quadrant IV, $\cos A = \frac{8}{17}$ and $\sin B = -\frac{6}{10}$.
Determine the exact value of $\sin(A - B)$.

{3} 56B Verify the trigonometric identity: $\sec x + \tan x = \frac{\cos x}{1 - \sin x}$

{4} 57A Algebraically determine the point of intersection of the graphs $y = 64 \cdot 16^x$ and $y = 4^{x+1}$.

- {4} 57B A truck's value depreciates by 40% of its original value every 3 years. Create an exponential function for the situation, and use the function to algebraically determine the amount of time it would take for the truck to be valued at 36% of its original value.

{4} 58 Algebraically solve for x : $\log_3(x + 6) + \log_3(x - 2) = 2$

{3} 59A Algebraically solve for n : ${}_{n+1}P_2 = 132$

{3} 59B In how many ways can the letters in the word DORITOS be arranged such that the two O's cannot be grouped together?