1. (1 point) Select all of the functions belwo which satisfy the differential equation $y'' + y = 0$. There may be more than one correct box that needs to be checked.

- A. $y = 0$

- B. $y = \cos(x) + \sin(x)$

- C. $y = 3\cos(x)$

- D. $y = \sin(x)$

- E. $y = \cos(x)$

- F. $y = e^x$

- G. $y = \sin(3x)$

- H. None of the above

Solution:
SOLUTION:
The correct answer is ABCDE.
Correct Answers:

- ABCDE

Consisder the function $y = xe^{2x}$. Which of the following differential equations is this a solution for?

- A. $y' = e^{2x} + 1$

- B. $y' = xy$

- C. $y' = 0$

- D. $y' - 2y = e^{2x}$

Solution:
SOLUTION:
The correct answer is D.
Correct Answers:

- D

The function $f(x) = \dfrac{1}{x-2}$ satisfies the differential equation $(x-2)f'(x) + f(x) = 0$ (you may assume this, but it would be good practice to check it yourself!). The function $f(x)$ is a solution for the differential equation on which of the following intervals? (Note: You should check to be sure the derivative $f'(x)$ is also defined on this interval.)

- A. $(-\infty, \infty)$

- B. $(-\infty, 2) \cup (2, \infty)$

- C. $(-\infty, 2)$

Solution:
SOLUTION:
The correct answer is C.
Correct Answers:

- C

4. (1 point)
Consider the intervals
A. $(-\infty, 8)$
B. $(-\infty, 8]$
C. $(8, \infty)$
D. $[8, \infty)$
E. $(-\infty, 8) \cup (8, \infty)$
F. $(-\infty, \infty)$.

Choose the interval which is the domain of the given function. (Not every interval may match with a function, and some intervals might be used more than once.)

(a) The domain of e^{x-8} is [Choose/A/B/C/D/E/F].

(b) The domain of $\dfrac{1}{(x-8)^6}$ is [Choose/A/B/C/D/E/F].

(c) The domain of $\ln(x-8)$ is [Choose/A/B/C/D/E/F].

(d) The domain of $\ln(8-x)$ is [Choose/A/B/C/D/E/F].

(e) The domain of $\sqrt{x-8}$ is [Choose/A/B/C/D/E/F].

(f) The domain of $\dfrac{1}{\sqrt{x-8}}$ is [Choose/A/B/C/D/E/F].

What is the domain of the function $y = \sqrt{2x-2}$?

- A. $(-\infty, \infty)$

- B. $[1, \infty)$

- C. $(1, \infty)$

What is the domain of the derivative $y' = \dfrac{1}{\sqrt{2x-2}}$?

- A. $[1, \infty)$

- B. $(1, \infty)$

- C. $(-\infty, \infty)$

The function $y = \sqrt{2x-2}$ satisfies the differential equation $y'y = 1$ (you may assume this, but it would be good practice to check it yourself!). The function y is a solution for the differential equation on which of the following intervals? (Note: the interval must be valid for the function, and its derivative.)

- A. $(-\infty, \infty)$

- B. $[1, \infty)$

- C. $(1, \infty)$

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6. (1 point) For the equation given below, find $\frac{dy}{dx}$.

$$5x^3y^2 - 4x^2y = 5.$$

$$\frac{dy}{dx} = \underline{\hspace{3cm}}$$

Solution: Taking the derivative with respect to x we get

$$0 = 15x^2y^2 + 10x^3y\frac{dy}{dx} - 8xy - 4x^2\frac{dy}{dx},$$

or

$$8xy - 15x^2y^2 = \left(10x^3y - 4x^2\right)\frac{dy}{dx}.$$

Therefore,

$$\frac{dx}{dy} = \frac{8xy - 15x^2y^2}{10x^3y - 4x^2}.$$

Correct Answers:

- (8*x*y-15*x^2*y^2)/(10*x^3*y-4*x^2)

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7. (1 point) Suppose the following are all solutions to a differential equation. Mark those that could be written as explicit solutions. There may be more than one correct box that needs to be checked.

- A. $ye^y = x$

- B. $y^2 = 3x^3 - x$

- C. $y(1+x) = x$

- D. $y^3 = 1 + x$

- E. $y = e^{3x}$

- F. $y^4 = y^2 - e^x$

- G. None of the above

8. (1 point)
Choose the best answer for the corresponding solution of a differential equation.

(a) The solution $y = c_1 \sin(x) + c_2 \cos(x)$ is a
- Choose
- particular solution
- 1-parameter family of solutions
- 2-parameter family of solutions
.

(b) The solution $y = Ce^{5x}$ is a
- Choose
- particular solution
- 1-parameter family of solutions
- 2-parameter family of solutions
.

(c) The solution $y = \ln(x - 4)$ is a
- Choose
- particular solution
- 1-parameter family of solutions
- 2-parameter family of solutions
.

(d) The solution $y = 0$ is also called the
- Choose
- null solution
- zero parameter
- trivial solution
.

Solution:
SOLUTION:
The answers are 2-parameter family of solutions, 1-parameter family of solutions, particular solution, trivial solution, and , respectivily.
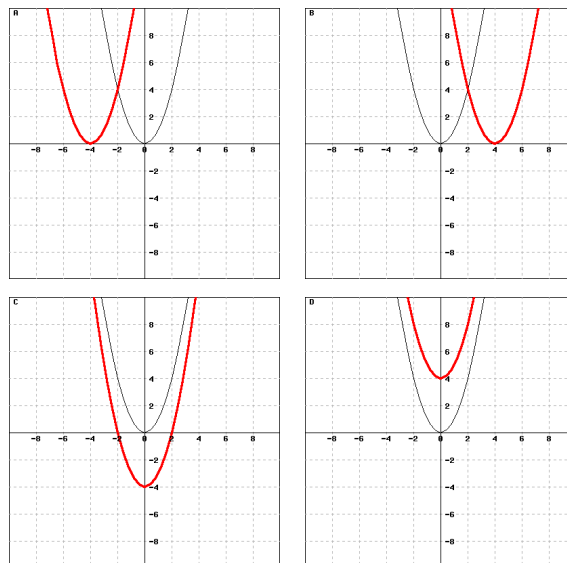
Correct Answers:
- 2-parameter family of solutions
- 1-parameter family of solutions
- particular solution
- trivial solution

9. (1 point)
Suppose $y = x^2 + 4$ is a solution to a differential equation. Which of the following is its integral curve. (In each graph, the graph of $y = x^2$ is in black, while the graph of $y = x^2 + 4$ is in (thicker) red.)

The correct graph is graph
- A

- B

- C

- D

Solution:
For $y = x^2$, when $x = 0$, $y = 0$, and the point on the parabola is $(0, 0)$.

For $y = x^2 + 4$, when $x = 0$, $y = 4$, and the point on the parabola is $(0, 4)$.

This implies the graph of $y = x^2 + 4$ is 4 units up compared to the graph of $y = x^2$.

D is the correct answer.

Correct Answers:
- D

10. (1 point) Enter a value for π _____
Correct Answers:
- 3.14159