EXTENSION 1

Stage 6

Calculus (Ext1), C3 Applications of Calculus (Y12), Differential Equations (Ext1)

Equations and Slope Fields

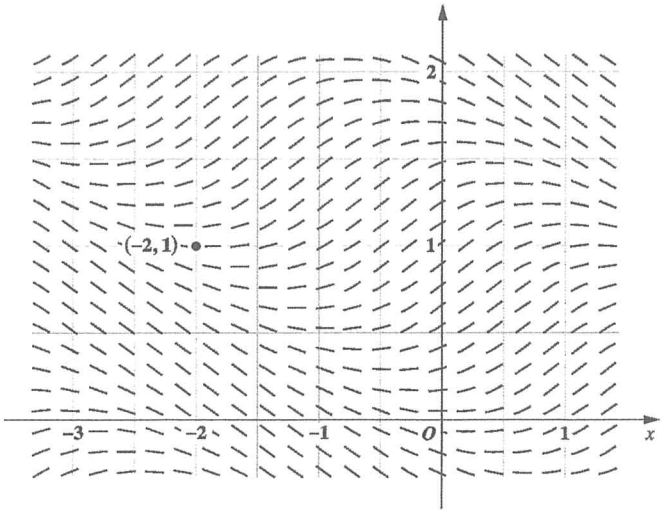
Teacher: Stewart Mitchell

Exam Equivalent Time: 24 minutes *(based on allocation of 1.5 minutes per mark)*

Questions

1. Calculus, EXT1 C3 2023 HSC 3 MC

The diagram shows the direction field of a differential equation. A particular solution to the differential equation passes through $(-2, 1)$.



Where does the solution that passes through $(-2, 1)$ cross the y-axis?

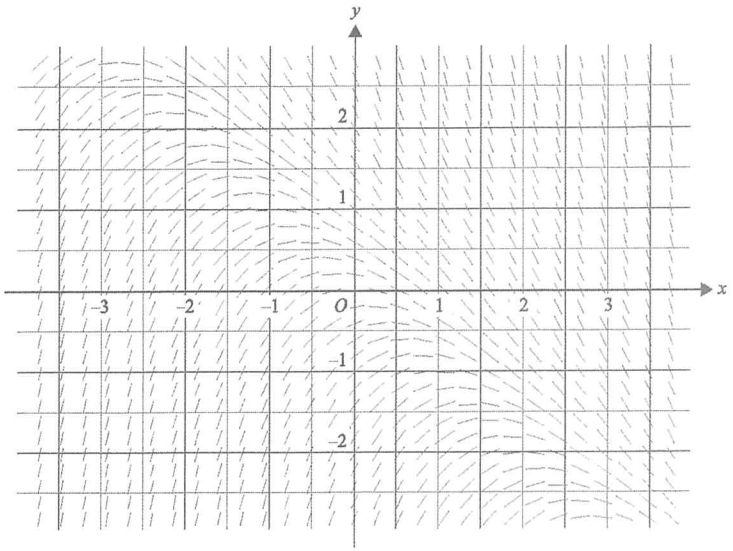
A. $y = 1.12$

B. $y = 1.34$

C. $y = 1.56$

D. $y = 1.78$

2. Calculus, EXT1 C3 2016 SPEC2 10 MC



The direction field for the differential equation $\frac{dy}{dx} + x + y = 0$ is shown above.

A solution to this differential equation that includes $(0, -1)$ could also include

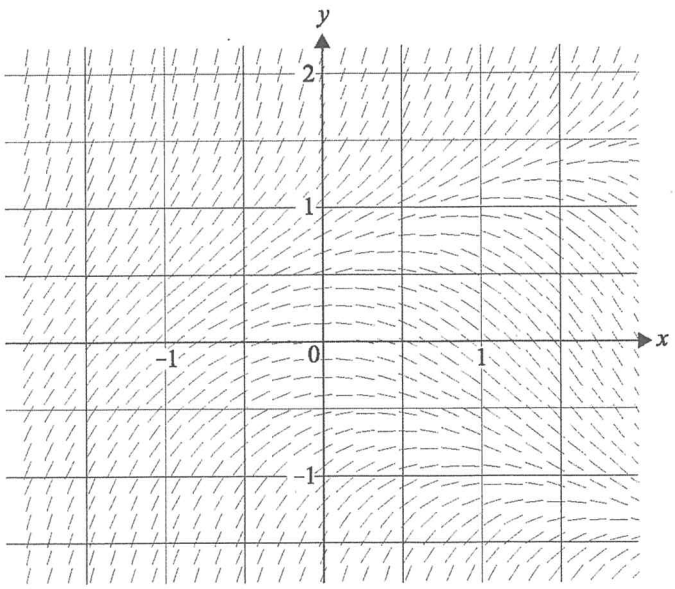
A. $(3, -1)$

B. $(3.5, -2.5)$

C. $(-1.5, -2)$

D. $(2.5, -1)$

3. Calculus, EXT1 C3 2017 SPEC2 8 MC



The differential equation that best represents the direction field above is

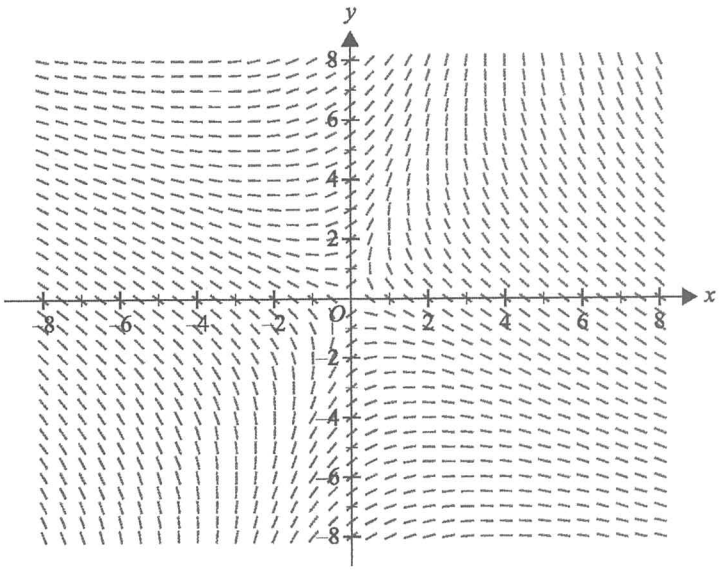
A. $\frac{dy}{dx} = x - y^2$

B. $\frac{dy}{dx} = y - x$

C. $\frac{dy}{dx} = y^2 - x^2$

D. $\frac{dy}{dx} = y^2 - x$

4. Calculus, EXT1 C3 2018 SPEC2 10 MC



The differential equation that best represents the direction field above is

A. $\frac{dy}{dx} = \frac{2x + y}{y - 2x}$

B. $\frac{dy}{dx} = \frac{x + 2y}{2x - y}$

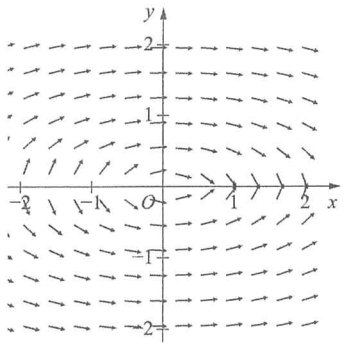
C. $\frac{dy}{dx} = \frac{2x - y}{x + 2y}$

D. $\frac{dy}{dx} = \frac{x - 2y}{y - 2x}$

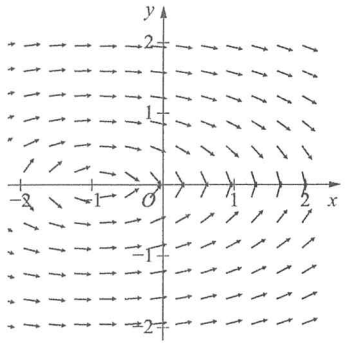
5. Calculus, EXT1 C3 2020 HSC 7 MC

Which of the following best represents the direction field for the differential equation $\frac{dy}{dx} = -\frac{x}{4y}$?

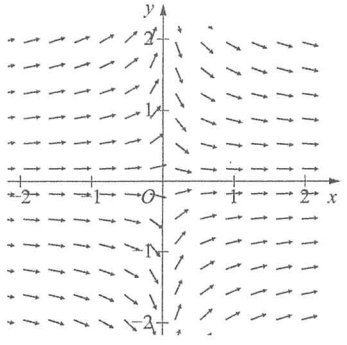
A.



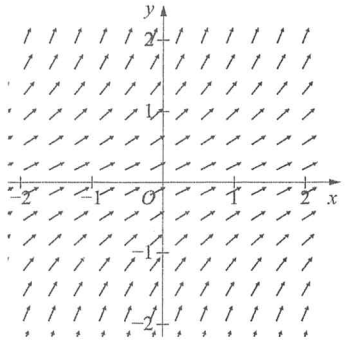
B.



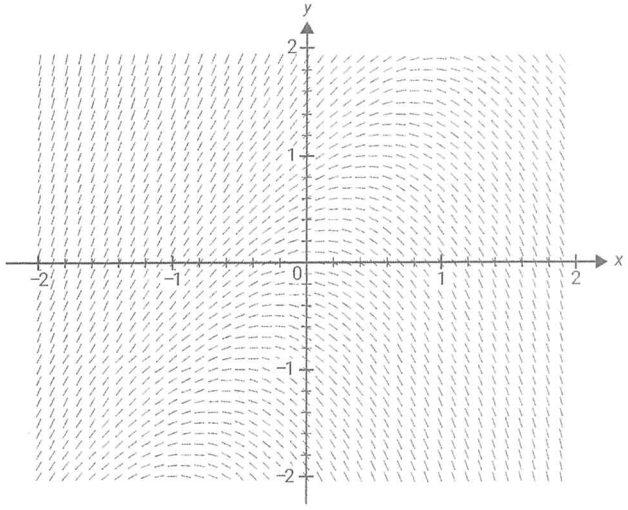
C.



D.



6. Calculus, EXT1 C3 2021 SPEC2 10 MC



The differential equation that has the diagram above as its direction field is

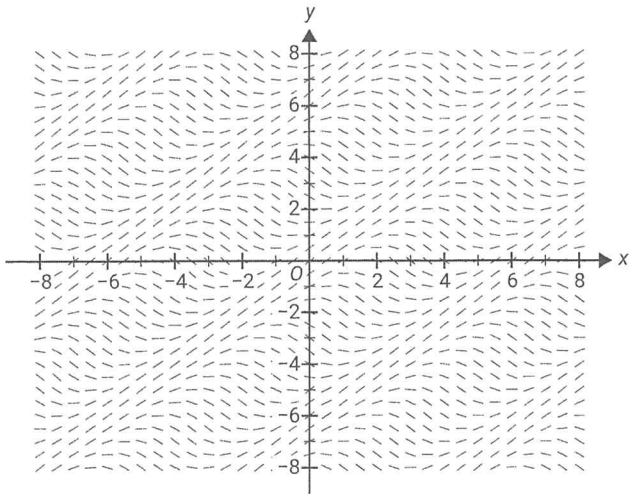
A. $\frac{dy}{dx} = y + 2x$

B. $\frac{dy}{dx} = 2x - y$

C. $\frac{dy}{dx} = x + 2y$

D. $\frac{dy}{dx} = y - 2x$

7. Calculus, EXT1 C3 2019 SPEC2 9 MC



The differential equation that has the diagram above as its direction field is

A. $\frac{dy}{dx} = \sin(y - x)$

B. $\frac{dy}{dx} = \cos(y - x)$

C. $\frac{dy}{dx} = \frac{1}{\cos(y - x)}$

D. $\frac{dy}{dx} = \frac{1}{\sin(y - x)}$

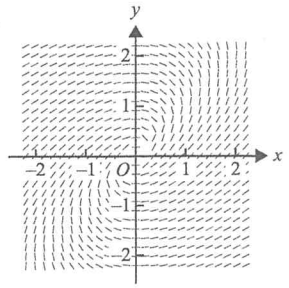
---

8. Calculus, EXT1 C3 2020 SPEC2 9 MC

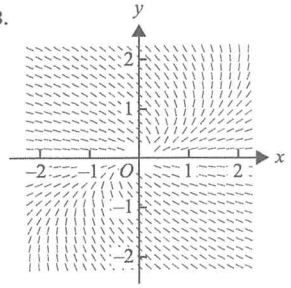
$P(x, y)$ is a point on a curve. The x-intercept of a tangent to point $P(x, y)$ is equal to the y-value at P.

Which one of the following slope fields best represents this curve?

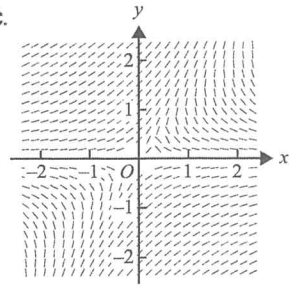
A.



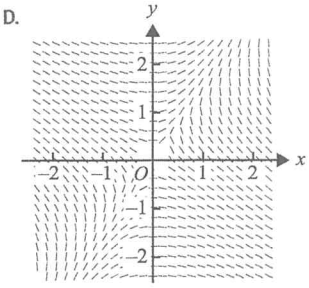
B.



C.



D.



---

9. Calculus, EXT1 C3 2017 SPEC1-N 7

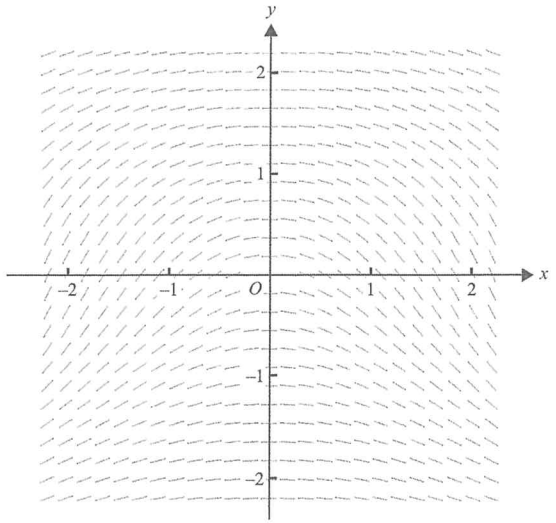
Let $\frac{dy}{dx} = (4 - y)^2$.

Express y in terms of x, where $y(0) = 3$. *(3 marks)*

---

10. Calculus, EXT1 C3 2017 SPEC1 8

A slope field representing the differential equation $\frac{dy}{dx} = -\frac{x}{1+y^2}$ is shown below.



a. Sketch the solution curve of the differential equation corresponding to the condition $y(-1) = 1$ on the slope field above and, hence, estimate the positive value of x when $y = 0$. Give your answer correct to one decimal place. ***(2 marks)***

b. Solve the differential equation $\frac{dy}{dx} = \frac{-x}{1+y^2}$ with the condition $y(-1) = 1$. Express your answer in the form $ay^3 + by + cx^2 + d = 0$, where a, b, c and d are integers. ***(2 marks)***

11. Calculus, EXT1 C3 2021 HSC 12a

The direction field for a differential equation is shown below.

The graph of a particular solution to the differential equation passes through the point P.

On the graph, sketch the graph of this particular solution. ***(1 mark)***