

ADVANCED (2027)

Stage 6

Functions (Adv-2027) Working with Functions (Y11) Linear Functions

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Exam Equivalent Time: 40.5 minutes (based on allocation of 1.5 minutes per mark)



Questions

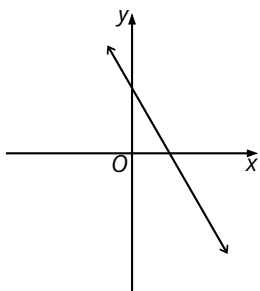
1. Functions, 2ADV F1 2019 HSC 2 MC

What values of x satisfy $4 - 3x \leq 12$?

- A. $x \leq -\frac{16}{3}$
- B. $x \geq -\frac{16}{3}$
- C. $x \leq -\frac{8}{3}$
- D. $x \geq -\frac{8}{3}$

2. Functions, 2ADV F1 2024 HSC 1 MC

Consider the function shown.



Which of the following could be the equation of this function?

- A. $y = 2x + 3$
- B. $y = 2x - 3$
- C. $y = -2x + 3$
- D. $y = -2x - 3$

3. Functions, 2ADV F1 2015 HSC 2 MC

What is the slope of the line with equation $2x - 4y + 3 = 0$?

- A. -2
- B. $-\frac{1}{2}$
- C. $\frac{1}{2}$
- D. 2

4. Functions, 2ADV F1 2017 HSC 1 MC

What is the gradient of the line $2x + 3y + 4 = 0$?

- A. $-\frac{2}{3}$
- B. $\frac{2}{3}$
- C. $-\frac{3}{2}$
- D. $\frac{3}{2}$

5. Functions, 2ADV F1 2018 HSC 3 MC

What is the x -intercept of the line $x + 3y + 6 = 0$?

- A. $(-6, 0)$
- B. $(6, 0)$
- C. $(0, -2)$
- D. $(0, 2)$

6. Algebra, STD2 A2 2019 HSC 14 MC

Last Saturday, Luke had 165 followers on social media. Rhys had 537 followers. On average, Luke gains another 3 followers per day and Rhys loses 2 followers per day.

If x represents the number of days since last Saturday and y represents the number of followers, which pair of equations model this situation?

- A.** Luke: $y = 165x + 3$
Rhys: $y = 537x - 2$
- B.** Luke: $y = 165 + 3x$
Rhys: $y = 537 - 2x$
- C.** Luke: $y = 3x + 165$
Rhys: $y = 2x - 537$
- D.** Luke: $y = 3 + 165x$
Rhys: $y = 2 - 537x$

7. Functions, 2ADV F1 2014 HSC 5 MC

Which equation represents the line perpendicular to $2x - 3y = 8$, passing through the point $(2, 0)$?

- A.** $3x + 2y = 4$
B. $3x + 2y = 6$
C. $3x - 2y = -4$
D. $3x - 2y = 6$

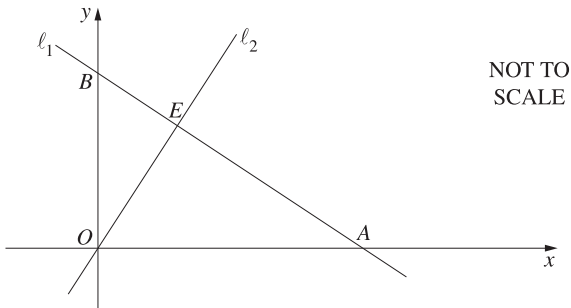
8. Functions, 2ADV F1 2007 HSC 1b

Solve $2x - 5 > -3$ and graph the solution on a number line. (2 marks)

9. Functions, 2ADV 2011 HSC 3c

The diagram shows a line l_1 , with equation $3x + 4y - 12 = 0$, which intersects the y -axis at B .

A second line l_2 , with equation $4x - 3y = 0$, passes through the origin O and intersects l_1 at E .



- a. Show that the coordinates of B are $(0, 3)$. (1 mark)

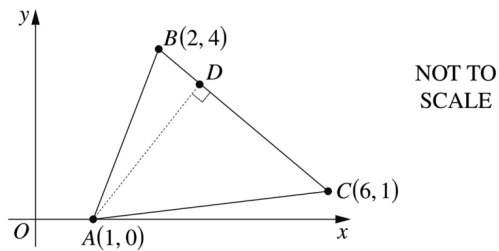
[illegible]

- b. Show that l_1 is perpendicular to l_2 . (2 marks)

[illegible]

10. Functions, 2ADV F1 2016 HSC 12a*

The diagram shows points $A(1, 0)$, $B(2, 4)$ and $C(6, 1)$. The point D lies on BC such that $AD \perp BC$.



- i. Show that the equation of BC is $3x + 4y - 22 = 0$. (2 marks)

- ii. Determine the gradient of AD . (1 mark)

11. Functions, 2ADV F1 2006 HSC 1e

Solve $3 - 5x \leq 2$. (2 marks)

12. Functions, 2ADV F1 2011 HSC 1e

Solve $2 - 3x \leq 8$. (2 marks)

13. Functions, 2ADV EQ-Bank 23

Solve the following simultaneous equations:

$3x - 4y = 5$

$x + 2y = 15.$ (2 marks)

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14. Functions, 2ADV EQ-Bank 24

Solve the following simultaneous equations

$6x - 7y = - 6$

$4x + 2y = 16$ (2 marks)

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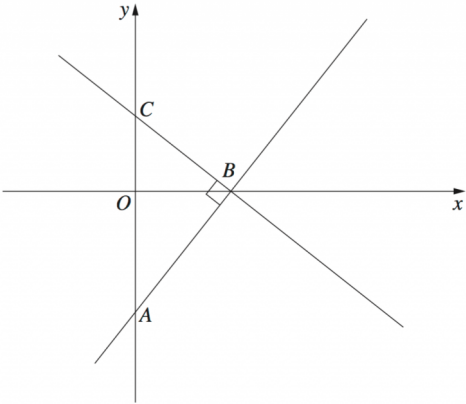
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15. Functions, 2ADV F1 2009 HSC 5a

In the diagram, the points A and C lie on the y -axis and the point B lies on the x -axis. The line AB has equation $y = \sqrt{3}x - 3$. The line BC is perpendicular to AB .



i. Find the equation of the line BC . (2 marks)

ii. Find the area of the triangle ABC . (2 marks)

Worked Solutions

1. Functions, 2ADV F1 2019 HSC 2 MC

$$\begin{aligned}4 - 3x &\leq 12 \\ -3x &\leq 8 \\ x &\geq -\frac{8}{3}\end{aligned}$$

$$\Rightarrow D$$

2. Functions, 2ADV F1 2024 HSC 1 MC

Gradient is negative (top left $\rightarrow$ bottom right)

y -intercept = 3 (only positive option)

$$\Rightarrow C$$

3. Functions, 2ADV F1 2015 HSC 2 MC

$$\begin{aligned}2x - 4y + 3 &= 0 \\ 4y &= 2x + 3 \\ y &= \frac{1}{2}x + \frac{3}{4}\end{aligned}$$

$$\Rightarrow C$$

4. Functions, 2ADV F1 2017 HSC 1 MC

$$\begin{aligned}2x + 3y + 4 &= 0 \\ 3y &= -2x - 4 \\ y &= -\frac{2}{3}x - \frac{4}{3}\end{aligned}$$

$$\Rightarrow A$$

5. Functions, 2ADV F1 2018 HSC 3 MC

x -intercept occurs when $y = 0$:

$$\begin{aligned}x + 0 + 6 &= 0 \\ x &= -6\end{aligned}$$

$\therefore x$ -intercept is $(-6, 0)$

$$\Rightarrow A$$

Worked Solutions

6. Algebra, STD2 A2 2019 HSC 14 MC

Luke starts with 165 and adds 3 per day:

$$y = 165 + 3x$$

Rhys starts with 537 and loses 2 per day:

$$y = 537 - 2x$$

$$\Rightarrow B$$

7. Functions, 2ADV F1 2014 HSC 5 MC

$$2x - 3y = 8$$

$$3y = 2x - 8$$

$$y = \frac{2}{3}x - \frac{8}{3}$$

$$m_{\text{perp}} = -\frac{3}{2} \quad (m_1 m_2 = -1 \text{ for } \perp \text{ lines})$$

Equation of line $m = -\frac{3}{2}$ through $(2, 0)$:

$$y - y_1 = m(x - x_1)$$

$$y - 0 = -\frac{3}{2}(x - 2)$$

$$y = -\frac{3}{2}x + 3$$

$$2y = -3x + 6$$

$$3x + 2y = 6$$

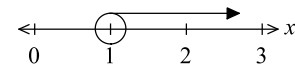
$$\Rightarrow B$$

8. Functions, 2ADV F1 2007 HSC 1b

$$2x - 5 > -3$$

$$2x > 2$$

$$x > 1$$



9. Functions, 2ADV 2011 HSC 3c

- a.** B is y -intercept of l_1

When $x = 0$:

$$(3 \times 0) + 4y - 12 = 0 \Rightarrow y = 3$$

$\therefore B$ is $(0, 3)$

- b.** $l_1: 3x + 4y - 12 = 0$

$$4y = -3x + 12$$

$$y = -\frac{3}{4}x + 3$$

$$m(l_1) = -\frac{3}{4}$$

$$l_2: 4x - 3y = 0$$

$$3y = 4x$$

$$y = \frac{4}{3}x$$

$$m(l_2) = \frac{4}{3}$$

$$m(l_1) \times m(l_2) = -\frac{3}{4} \times \frac{4}{3} = -1$$

$\therefore l_1$ and l_2 are perpendicular

10. Functions, 2ADV F1 2016 HSC 12a*

- i.** $B(2, 4)$, $C(6, 1)$

$$m_{BC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 4}{6 - 2} = -\frac{3}{4}$$

Equation of BC , $m = -\frac{3}{4}$ through $(2, 4)$:

$$y - y_1 = m(x - x_1)$$

$$y - 4 = -\frac{3}{4}(x - 2)$$

$$4y - 16 = -3x + 6$$

$$3x + 4y - 22 = 0 \dots \text{as required.}$$

- ii.** Perpendicular lines: $m_1 \times m_2 = -1$

$$m_{BC} = -\frac{3}{4} \Rightarrow m_{AD} = \frac{4}{3} \quad (BC \perp AD)$$

11. Functions, 2ADV F1 2006 HSC 1e

$$3 - 5x \leq 2$$

$$-5x \leq -1$$

$$x \geq \frac{1}{5}$$

12. Functions, 2ADV F1 2011 HSC 1e

$$2 - 3x \leq 8$$

$$-3x \leq 6$$

$$x \geq -\frac{6}{3}$$

$$x \geq -2$$

13. Functions, 2ADV EQ-Bank 23

$$3x - 4y = 5 \dots (1)$$

$$x + 2y = 15 \dots (2)$$

Multiply $(2) \times 3$:

$$3x + 6y = 45 \dots (2')$$

Subtract $(2') - (1)$:

$$10y = 40 \Rightarrow y = 4$$

Substitute $y = 4$ into (2) :

$$x + 2 \times 4 = 15 \Rightarrow x = 7$$

14. Functions, 2ADV EQ-Bank 24

$$6x - 7y = -6 \dots (1)$$

$$4x + 2y = 16 \dots (2)$$

Mult $(1) \times 2$ and $(2) \times 3$:

$$12x - 14y = -12 \dots (1')$$

$$12x + 6y = 48 \dots (2')$$

Subtract $(2') - (1')$:

$$20y = 60 \Rightarrow y = 3$$

Substitute $y = 3$ into (2) :

$$4x + 6 = 16 \Rightarrow x = \frac{5}{2}$$

15. Functions, 2ADV F1 2009 HSC 5a

i. Gradient of $AB = \sqrt{3}$

$$\therefore m_{BC} = -\frac{1}{\sqrt{3}} \quad (BC \perp AB)$$

Finding B ,

$$0 = \sqrt{3}x - 3$$

$$\sqrt{3}x = 3$$

$$x = \frac{3}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \sqrt{3}$$

$$\therefore B(\sqrt{3}, 0)$$

Equation of BC has $m = -\frac{1}{\sqrt{3}}$ through $(\sqrt{3}, 0)$:

$$y - y_1 = m(x - x_1)$$

$$y - 0 = -\frac{1}{\sqrt{3}}(x - \sqrt{3})$$

$$y = -\frac{1}{\sqrt{3}}x + 1$$

ii. AB cuts y -axis when $x = 0$, $y = -3$

$$\Rightarrow A(0, -3)$$

BC cuts y -axis when $x = 0$, $y = 1$

$$\Rightarrow C(0, 1)$$

$$\therefore AC = 4$$

$$OB = \sqrt{3}$$

$$\begin{aligned} \text{Area } \triangle ABC &= \frac{1}{2} \times AC \times OB \\ &= \frac{1}{2} \times 4 \times \sqrt{3} \\ &= 2\sqrt{3} \text{ u}^2 \end{aligned}$$