



Calculator Assumed
Linear and Quadratic Equations and Functions

Time: 45 minutes

Total Marks: 45

Your Score: / 45

Question One: [2, 2, 2 = 6 marks]

Consider the function $f(x) = 2x - 5$.

- (a) Which of these functions are parallel to $f(x)$?

Circle or highlight all solutions.

$$2x + y = 10$$

$$y = 5x - 2$$

$$2y = 4x + 3$$

$$y - 2x = -7$$

- (b) Which of these functions have the same vertical intercept as $f(x)$?

Circle or highlight all solutions.

$$3x - y = 5$$

$$y = 5x - 2$$

$$2y = -6x - 10$$

$$y - 5 = 2x$$

- (c) Which of these functions have the same horizontal intercept as $f(x)$?

Circle or highlight all solutions.

$$y = 2x + 2.5$$

$$y = 2x - 7$$

$$4x - y = 10$$

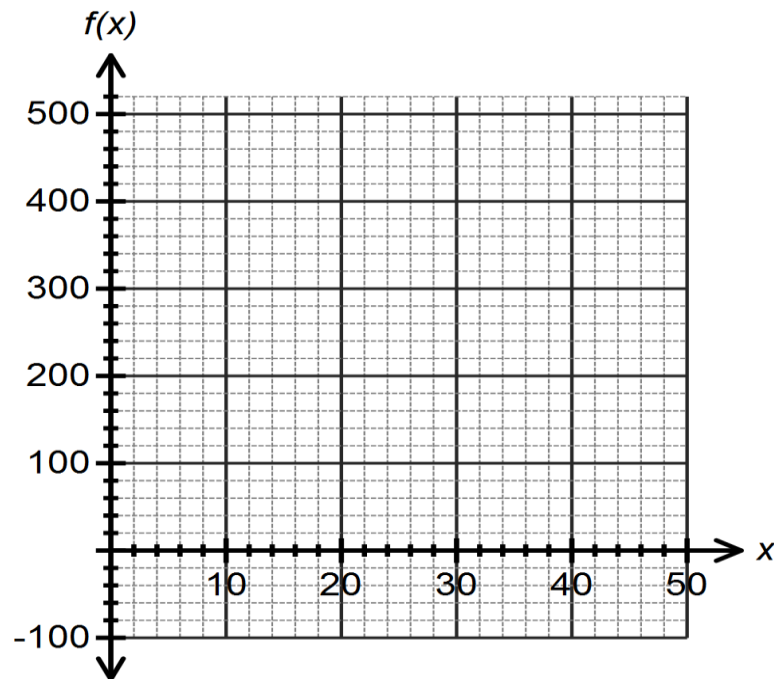
$$y = \frac{6x - 15}{7}$$

Question Two: [3, 1, 2, 2 = 9 marks]

The supply of S units of a particular product is given by $S = 100 + 10x$ where x is the number of days since production recommenced after a cease in production.

The demand for D units of this particular product is given by $D = 10 + 40x - x^2$.

- (a) Sketch each of these functions on the axes below.

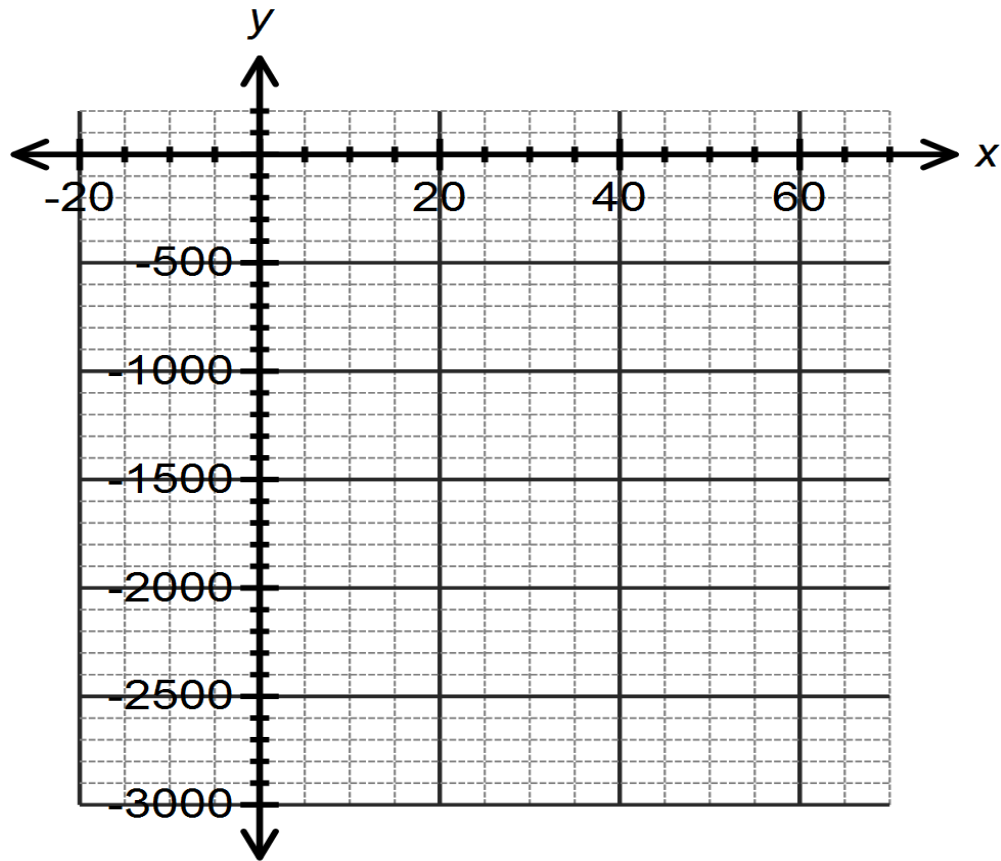


Use your graph to answer the following questions, correct to 2 decimal places:

- (b) After how many days does demand meet supply the first time?
- (c) For how many days does business “look good”, that is, demand is greater than supply?
- (d) After how many days should the company look into a new advertising campaign? Justify your answer.

Question Three: [4, 3 = 7 marks]

- (a) On the axes below sketch the function $y = 2x^2 - 116x - 910$, showing all intercepts and turning points.



- (b) Hence or otherwise transform the equation of the function into the form $y = a(x + d)(x + e)$

Question Four: [3, 2 = 5 marks]

There are three children in a family. The eldest is twice the age of the youngest. The middle child is 3 years younger than the eldest. The sum of their ages is 47 years. Let x represent the age of the youngest child.

- (a) Write an equation in one variable to represent this situation.

- (b) Determine the age of each child.

Question Five: [3, 2 = 5 marks]

The area of a right triangle is 20 cm^2 .

The base is 3cm less than the height.

- (a) Write an equation in one variable to represent this situation.

- (b) Determine the dimensions of the triangle.

Question Six: [3, 1 = 4 marks]

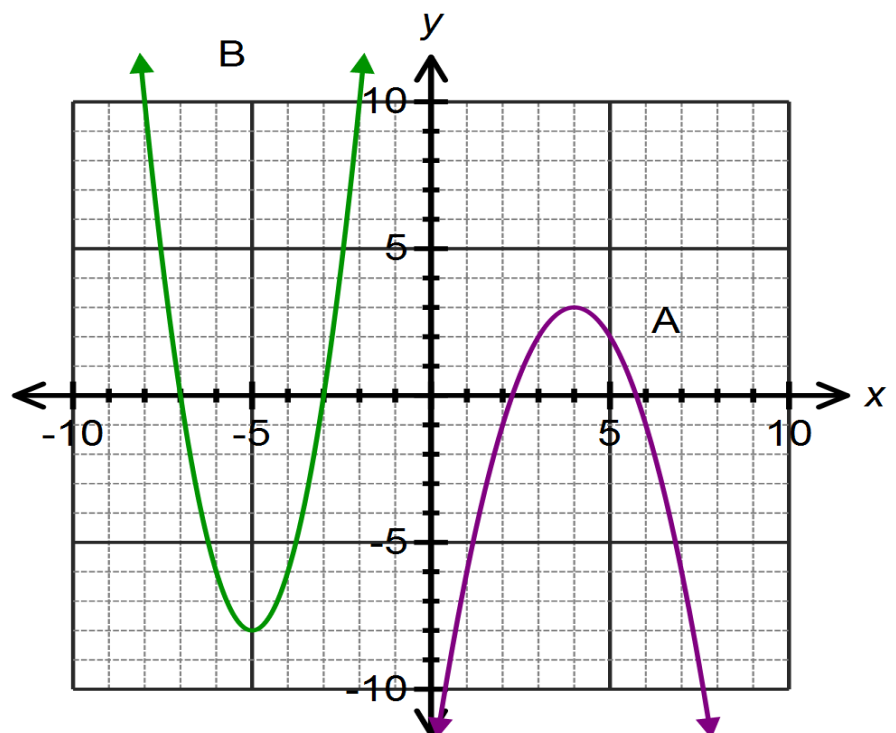
- (a) Explain, with reference to the discriminant in the quadratic formula, why the function $f(x) = 2x^2 - 12x + 18$ has only one root.
- (b) From your answer in part (a), what can you say about the turning point of this function?

Question Seven: [3, 3 = 6 marks]

Determine the equation of each of the functions drawn below.

A:

B:



Question Eight: [3 marks]

Isabel throws a ball for her dog to catch. The path of the ball is parabolic and can be modeled by the equation $h = -x^2 + 4x + 1.5$ where h is the height in metres of the ball above the ground and x is the horizontal distance of the ball from Isabel.

If Isabel's dog is 4m away from her, how far does he have to jump to catch the ball?

Provide a sketch to illustrate your answer.



SOLUTIONS
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Question One: [2, 2, 2 = 6 marks]

Consider the function $f(x) = 2x - 5$.

- (a) Which of these functions are parallel to $f(x)$?

Circle or highlight all solutions.

$$2x + y = 10$$

$$2y = 4x + 3$$

$$y = 5x - 2$$

$$y - 2x = -7$$



- (b) Which of these functions have the same vertical intercept as $f(x)$?

Circle or highlight all solutions.

$$3x - y = 5$$

$$2y = -6x - 10$$

$$y = 5x - 2$$

$$y - 5 = 2x$$



- (c) Which of these functions have the same horizontal intercept as $f(x)$?

Circle or highlight all solutions.

$$y = 2x + 2.5$$

$$4x - y = 10$$

$$y = 2x - 7$$

$$y = \frac{6x - 15}{7}$$

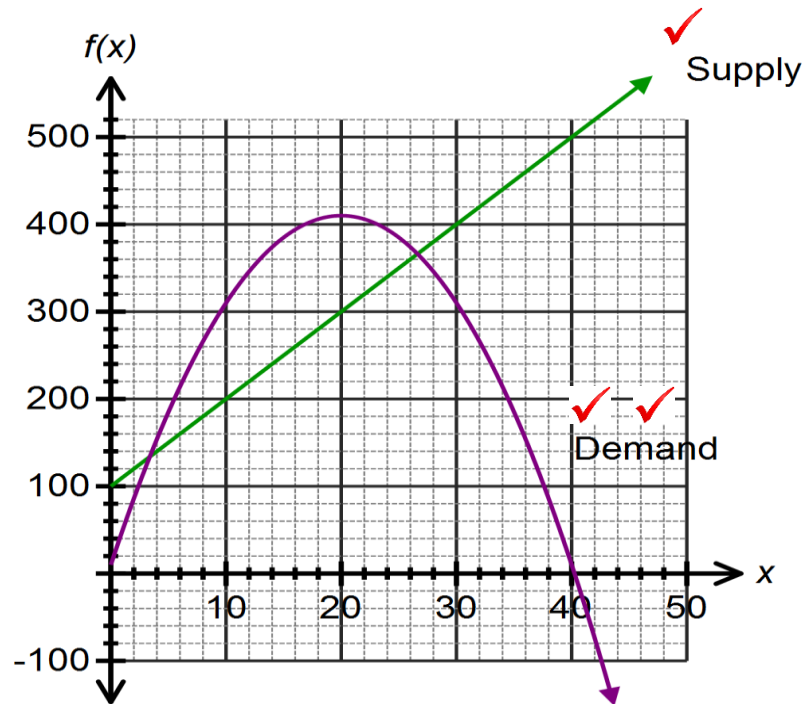


Question Two: [3, 1, 2, 2 = 9 marks]

The supply of S units of a particular product is given by $S = 100 + 10x$ where x is the number of days since production recommenced after a cease in production.

The demand for D units of this particular product is given by $D = 10 + 40x - x^2$.

- (a) Sketch each of these functions on the axes below.



Use your graph to answer the following questions, correct to 2 decimal places:

- (b) After how many days does demand meet supply the first time?

3.38 days

- (c) For how many days does business “look good”, that is, demand is greater than supply?

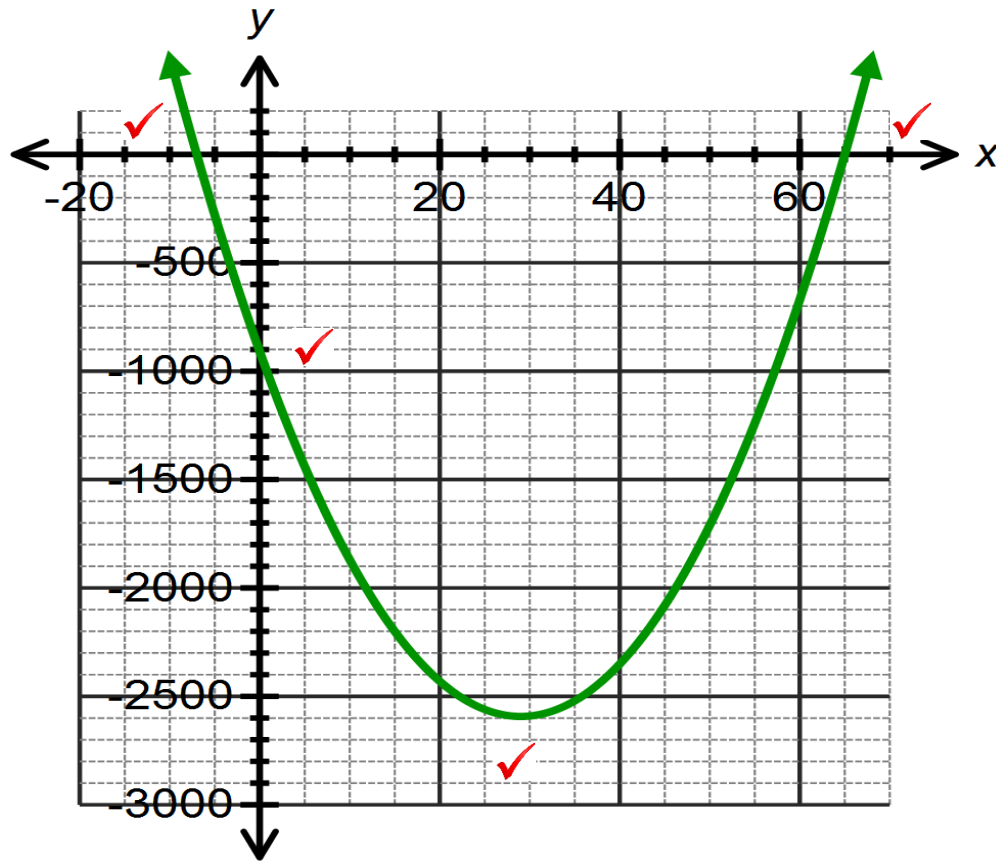
$26.62 - 3.38 = 23.24 \therefore 23$ days

- (d) After how many days should the company look into a new advertising campaign? Justify your answer.

After 26.62 days. This is when demand starts to fall below supply.

Question Three: [4, 3 = 7 marks]

- (a) On the axes below sketch the function $y = 2x^2 - 116x - 910$, showing all intercepts and turning points.



- (b) Hence or otherwise transform the equation of the function into the form $y = a(x+d)(x+e)$

$$y = 2(x+7)(x-65)$$

✓ ✓ ✓

Question Four: [3, 2 = 5 marks]

There are three children in a family. The eldest is twice the age of the youngest. The middle child is 3 years younger than the eldest. The sum of their ages is 47 years. Let x represent the age of the youngest child.

- (a) Write an equation in one variable to represent this situation.

$$x + 2x - 3 + 2x = 47$$

$$5x - 3 = 47$$

- (b) Determine the age of each child.

$$5x = 50$$

$$x = 10$$

Youngest is 10 years old

Middle child is 17 years old

Eldest child is 20 years old.

Question Five: [3, 2 = 5 marks]

The area of a right triangle is 20 cm^2 .

The base is 3cm less than the height.

- (a) Write an equation in one variable to represent this situation.

$$A = \frac{1}{2} \times b \times h$$

$$0 = \frac{1}{2} x(x - 3)$$

- (b) Determine the dimensions of the triangle.

$$x = -5, 8$$

Discard -5 , not possible in this context

The base is 5 cm and the height is 8 cm.

Question Six: [3, 1 = 4 marks]

- (a) Explain, with reference to the discriminant in the quadratic formula, why the function $f(x) = 2x^2 - 12x + 18$ has only one root.

$$\begin{aligned}\Delta &= b^2 - 4ac \quad \checkmark \\ &= (-12)^2 - 4(2)(18) \quad \checkmark \\ &= 144 - 144 \\ &= 0\end{aligned}$$

Since the discriminant is zero, there is only one root. ✓

- (b) From your answer in part (a), what can you say about the turning point of this function?

The turning point is on the x – axis. ✓

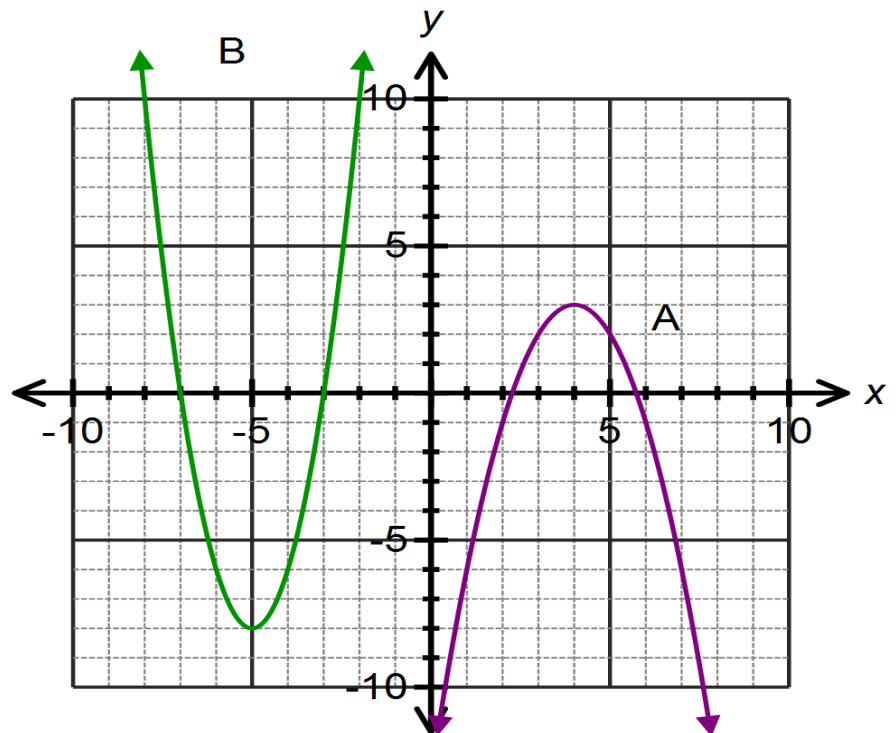
Question Seven: [3, 3 = 6 marks]

Determine the equation of each of the functions drawn below.

A: $y = -(x-4)^2 + 3$ ✓
✓

B: $y = 2(x+7)(x+3)$ ✓ ✓ ✓

Or $y = 2(x+5)^2 - 8$

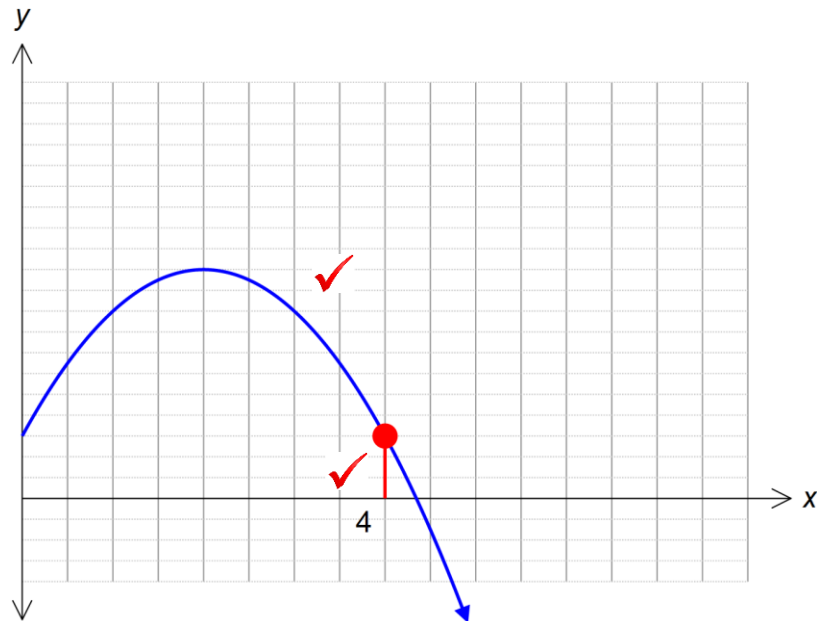


Question Eight: [3 marks]

Isabel throws a ball for her dog to catch. The path of the ball is parabolic and can be modeled by the equation $h = -x^2 + 4x + 1.5$ where h is the height in metres of the ball above the ground and x is the horizontal distance of the ball from Isabel.

If Isabel's dog is 4m away from her, how far does he have to jump to catch the ball?

Provide a sketch to illustrate your answer.



The dog has to jump 1.5m to catch the ball.

