Quadratics and Parabolas - Applications test

Name: _____ Date: _____

16 questions | 60 marks | 60 minutes

Use quadratic models in area, design, motion and revenue problems, and justify useful answers within stated domains.

A scientific calculator may be used.

1. A rectangular garden is 4 m longer than it is wide. Its area is 96 m². Find its width and length. [3 marks]

2. An 8 cm by 12 cm picture has a uniform border. The picture and border together cover 140 cm². Find the border width. [4 marks]

3. Two consecutive positive integers have product 156. Find them. [3 marks]

4. A ball is modelled by $h = -t^2 + 8t + 2$, where h is metres and t is seconds after release. [4 marks]

(a) Find the release height. [1 mark]

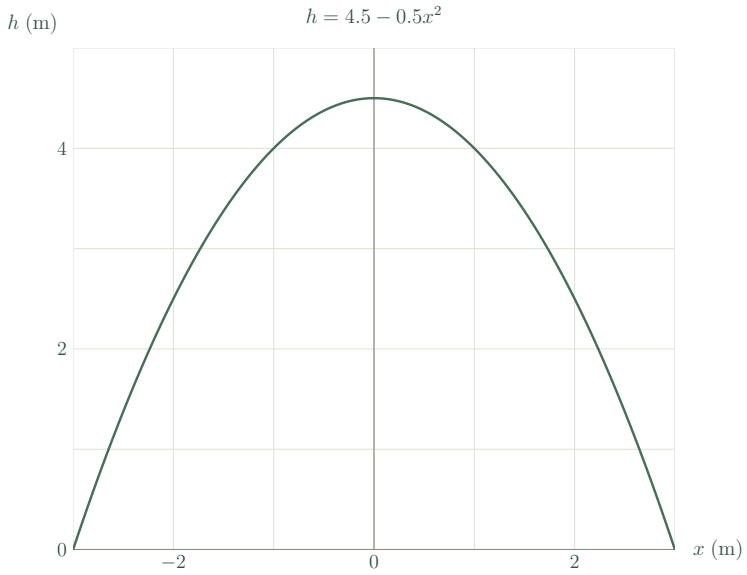
(b) Find the greatest height and when it occurs. [3 marks]

5. For $h = -t^2 + 8t + 2$, find the two non-negative times when the ball is 14 m high. Explain why two times are possible. [4 marks]

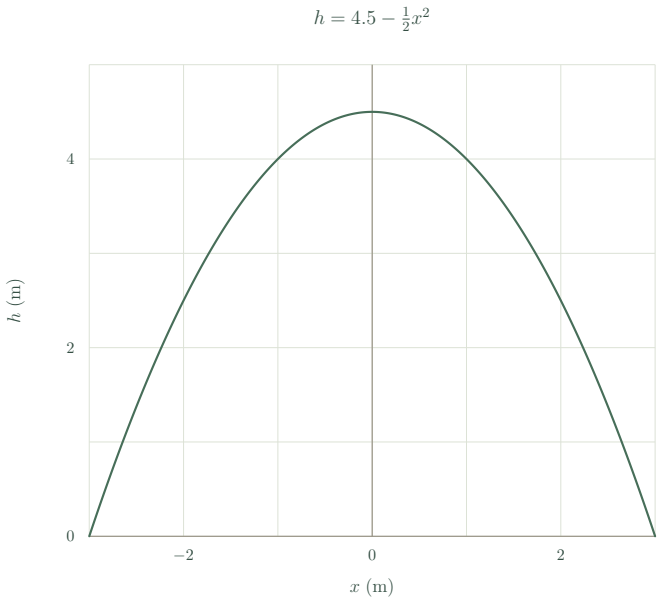
6. A rectangular tank is 2 m deep. Its length is 3 m more than its width. It holds 80 m³ when full. Find its width and length. [4 marks]

7. A 24 m wire makes a rectangle. Let its width be x metres. Find the greatest possible area and the dimensions giving it. [4 marks]

8. The arch shown has $h = 4.5 - 0.5x^2$ for $-3 \le x \le 3$. Find its ground-level width and greatest height. [3 marks]



9. A rectangular truck is 4 m wide and 3 m high. It is centred beneath an arch with $h = 4.5 - 0.5x^2$ metres. Does it fit without touching? Justify using its upper corners. [3 marks]



10. A stall has modelled profit $P = -n^2 + 16n - 39$ dollars for whole-number n from 0 to 16. For which values of n is the profit positive? [4 marks]

11. A demand model predicts $(60-p)$ tickets sold at p dollars each, for $0 \le p \le 60$. Find the revenue-maximising price and predicted revenue. [3 marks]

12. A rectangular pen against a straight wall uses 40 m of fencing for the other three sides. Let each side perpendicular to the wall have length x metres. Find the greatest area. [4 marks]

13. Two moving objects have height models $h_A = -t^2 + 6t + 1$ and $h_B = -2t^2 + 8t + 1$, in metres. At what time after $t = 0$ are their heights equal, and what is that height? [4 marks]

14. A ball has height $h = -5t^2 + 10t + 1$ metres, where t is seconds. Use the model from release until its first ground contact. [5 marks]

(a) Find the greatest height. [2 marks]

(b) Find the ground-contact time to two decimal places. [3 marks]

15. A rectangle has diagonal 13 cm. Its length is 7 cm more than its width. Use Pythagoras and a quadratic equation to find its sides. [4 marks]

16. A production model is $C = n^2 - 10n + 40$ dollars for $0 \le n \le 12$. A student tries to find its minimum by solving $C = 0$. Explain why this fails and find the true minimum. [4 marks]