

## Calculus – Answers

### Finding Gradients using Differentiation 1

- 1)  $\frac{dy}{dx} = 5x^4$  (a) 5 (b) 80 (c) 5
- 2)  $\frac{dy}{dx} = 3x^2 - 6x$  (a) 0 (b) 0 (c) 9
- 3)  $\frac{dy}{dx} = 3x^2 - 12$  (a) -9 (b) 15 (c) 0, so (2, -16) is a turning point of the graph
- 4) (a)  $\frac{dy}{dx} = 28x^6$  (b)  $\frac{dy}{dx} = 10x^4 - 14x$  (c)  $\frac{dy}{dx} = 24x^2 - 5$

### Finding Gradients using Differentiation 2

- 1)  $\frac{dy}{dx} = 3x^2 + 10x - 3$  (a) 29 (b) 54 (c) -10
- 2)  $\frac{dy}{dx} = \frac{-3}{x^4}$  (a) -3 (b)  $-\frac{3}{16}$
- 3)  $\frac{dy}{dx} = \frac{-6}{x^3} + \frac{1}{x^2}$  (a) -5 (b)  $-\frac{1}{9}$
- 4) (a)  $\frac{dy}{dx} = 2x - 2$  (b)  $\frac{-4}{x^2} + \frac{10}{x^3}$  (c)  $\frac{dy}{dx} = 6x - 2$

### Finding turning points using differentiation

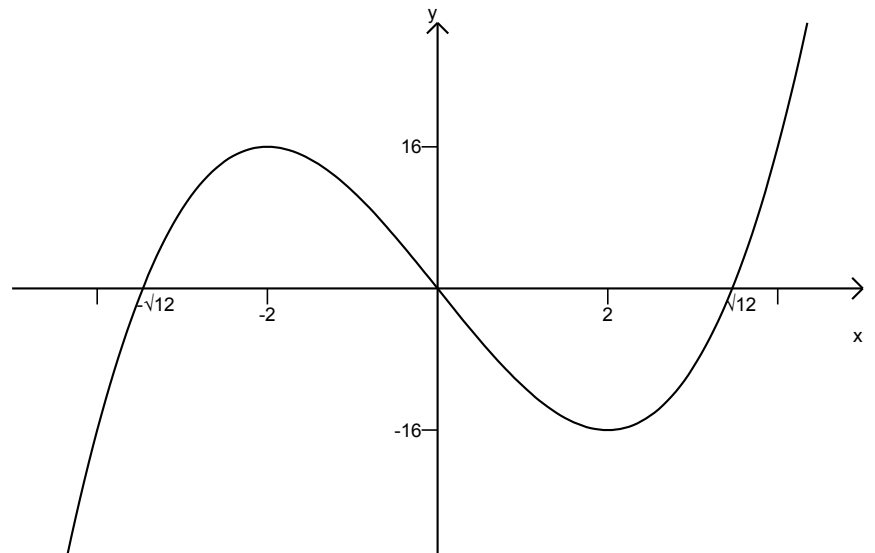
1) (a) (2, -16) and (-2, 16)

(b) (2, 16)

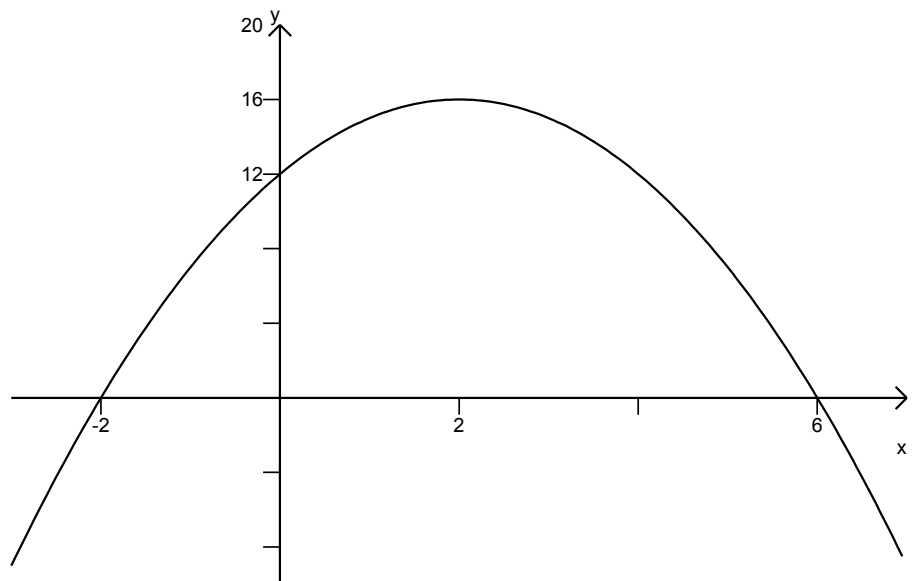
(c) (-2, -12)

(d) (3, -81) and (-2, 44)

2) (a) (0, 0), ( $\sqrt{12}$ , 0) and ( $-\sqrt{12}$ , 0)



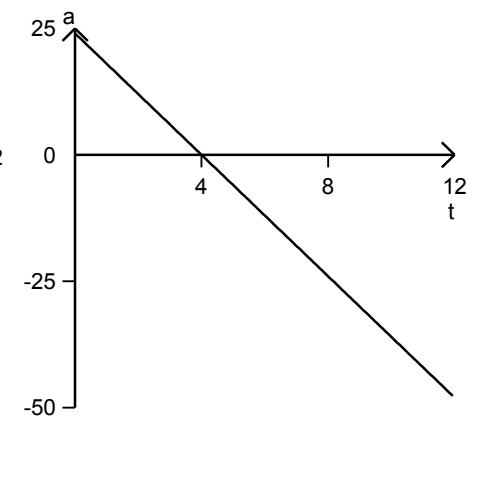
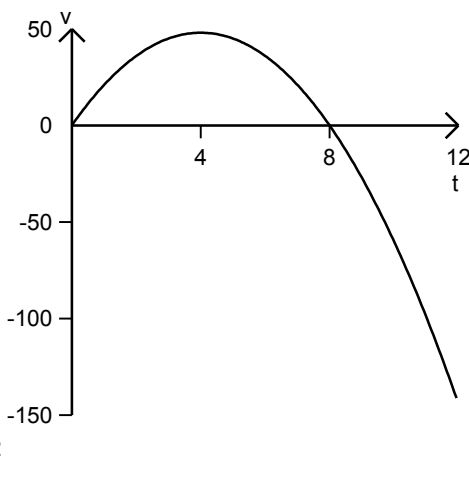
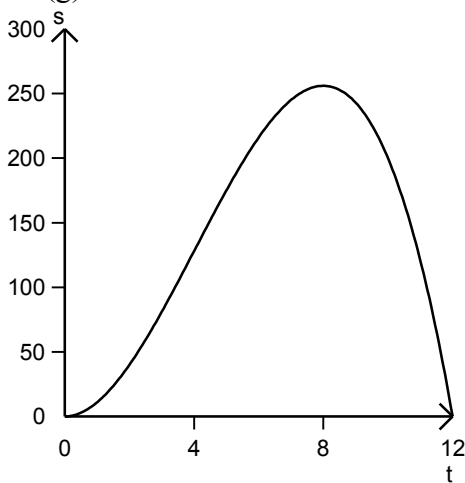
(b) (0, 12), (6, 0) and (-2, 0)



## Velocity, Acceleration and other Rates of change

- 1) (a)  $v = 60 - 10t$   
 (b) (i) 160m (ii) 20m/s  
 (c) (i) 160m (ii) -20m/s The ball is falling  
 (d) 6 seconds. The ball stops going up and starts to fall.  
 (e) 12 seconds  
 (f)  $-10 \text{ m/s}^2$  caused by gravity

- 2) (a)  $v = 24t - 3t^2$   
 (b)  $a = 24 - 6t$   
 (c)  $t = 6$ . The velocity stops increasing and starts to decrease.  
 (d) 36 m/s  
 (e)  $t = 0$  and  $t = 8$ . At  $t=8$  the distance from O stops increasing and starts to decrease  
 (f) 256m  
 (g)



- 3) 14000 ants per day  
 4) -8 degrees per minute. The object is getting cooler.

## Specimen IGCSE Calculus Questions

- 1) (a)  $3x^2 + 2x - 5$  (b)  $8x^3 - 10x + 2$  (c)  $15x^4 + 21x^2 - 1$   
 (d)  $-2 + 8x - 6x^2$  (e)  $\frac{x^2}{2} + 3\frac{x}{2} - \frac{2}{3}$  (f)  $-x$
- 2) (a)  $6x^2 + 8x - x^{-2}$  (b)  $6 + 4x^{-2} - 6x^{-3}$  (c)  $-\frac{2}{x^2} + \frac{12}{x^3}$
- 3) (a)  $5x^4 - 9x^2 + 2$  (b)  $3 - \frac{8}{x^3}$  (c)  $2x + \frac{2}{3}$
- 4) (a) -1 (b) 61 (c) 67 (d)  $\frac{3}{4}$
- 5) (a)  $2x + 6$  (b)  $4x + 7$  (c)  $10 - 6x$  (d)  $8x - 6x^2$
- 6) (a)  $2x - 3$  (b) 1 (c) (-1, 9)
- 7) (a) (2, 0) (b) (1, 2) and (3, -2)

8) (a)  $2x - 4$                       (b) (2, 1)                      (c)  $\frac{d^2y}{dx^2} = 2$  which is positive, so TP is a minimum

9)  $\frac{15}{2}$                        $\frac{d^2y}{dx^2} = -4$  which is negative so TP is a maximum

10) (a) £2                      (b) £20000

11) (a)  $2t - 6$  degrees per second                      (b)  $t = 1.5$  seconds

12) (a)  $t = 10$                       (b)  $10 - 2t$                       (c) 25m                      (d) 4 m/s                      (e)  $-2 \text{ m/s}^2$

13) (a) (2, 8) and (-2, -8)  
(b)

x	-4	-3	-2	-1	1	2	3	4
y	-10	-8.7	-8	-10	10	8	8.7	10

(c)

