

Answers to Grade Gobbler 5

Answer 1

$$|AC| = \sqrt{7^2 + 4^2} = \sqrt{65} \quad (\text{About } 8.06 \text{ cm})$$
$$\angle HAC = \arctan\left(\frac{3}{\sqrt{65}}\right) = 20.4^\circ$$

[4 marks]

Answer 2

$$f(x) = 1 + \frac{7x^2}{4} - x^3$$
$$f'(x) = \frac{7x}{2} - 3x^2$$
$$f'(3) = -16.5$$

[4 marks]

Answer 3

$$\int_1^9 \frac{8}{\sqrt{x}} dx = 8 \int_1^9 8x^{-\frac{1}{2}} dx$$
$$= \left[16x^{\frac{1}{2}} \right]_1^9$$
$$= 32$$

[4 marks]

Answer 4

(i)

$$x^2 + y^2 - 8x + 2y + 8 = 0$$
$$[x^2 - 8x] + [y^2 + 2y] + 8 = 0$$
$$[(x - 4)^2 - 16] + [(y + 1)^2 - 1] + 8 = 0$$
$$(x - 4)^2 + (y + 1)^2 = 3^2$$

[3 marks]

(ii) Centre $(4, -1)$, Radius 3

[2 marks]

Answer 5**(i)** Minimum working :

$$x = \frac{-1 \pm \sqrt{1^2 - 4 \times 1 \times (-1)}}{2 \times 1}$$

$$x = \frac{-1 \pm \sqrt{5}}{2}$$

$$x = -1.62, 0.618$$

[4 marks]

$$\textbf{(ii)} \quad D = 8^2 - 4 \times 1 \times 26 = -40$$

[2 marks]

(iii) The negative discriminant can't be square rooted over the reals.
 $\therefore$ Quadratic has no solutions in Real numbers.

[1 mark]**Answer 6**

$$\textbf{(a)} \quad \textbf{(i)} \quad {}^7C_3 = 35 \quad \textbf{(ii)} \quad {}^{11}C_7 = 330 \quad \textbf{(iii)} \quad {}^{16}C_4 = 1820$$

[3 marks]

$$\begin{aligned} \textbf{(b)} \quad \textbf{(i)} \quad P (2 \text{ blue }) &= {}^5C_2 0.14^2 0.86^3 \\ &= 0.125 \end{aligned}$$

[2 marks]

$$\begin{aligned} \textbf{(ii)} \quad P (4 \text{ blue }) &= {}^5C_4 \left(\frac{1}{13} \right)^4 \left(\frac{12}{13} \right)^1 \\ &= 0.001 \, 659 \end{aligned}$$

[2 marks]

(iii) Eating a Smartie™ does not alter the 14% : 86%
 balance of probabilities.

[1 mark]

Answer 7

$$\begin{aligned}
 \text{(a)} \quad v^2 &= u^2 + 2as \\
 2as &= v^2 - u^2 \\
 s &= \frac{v^2 - u^2}{2a}
 \end{aligned}$$

[1 mark]

$$\begin{aligned}
 \text{(b) (i)} \quad \text{Hump separation} &= \frac{9^2 - 4^2}{2 \times 2.5} + \frac{4^2 - 9^2}{2 \times (-3)} \\
 &= 13 + \frac{65}{6} = \frac{143}{6} \quad (\text{About } 23.83 \text{ m})
 \end{aligned}$$

[2 marks]

$$\begin{aligned}
 \text{(ii)} \quad v &= u + at \Leftrightarrow t = \frac{v - u}{a} \\
 \text{Total Time} &= \frac{9 - 4}{2.5} + \frac{4 - 9}{(-3)} \\
 &= 2 + \frac{5}{3} = 3.67 \text{ seconds}
 \end{aligned}$$

[2 marks]

(iii) Various: e.g. Car has length, which a particle does not.

[1 mark]

Answer 8

$$\begin{aligned}
 &\text{By the remainder theorem } f\left(\frac{1}{2}\right) = -1.75 \\
 4 \times \left(\frac{1}{2}\right)^4 + p\left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^2 - 2 &= -1.75 \\
 p &= -2
 \end{aligned}$$