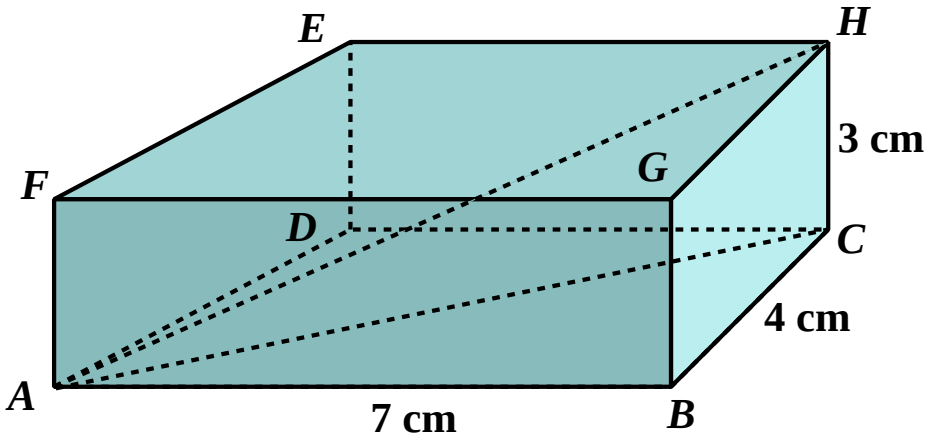
Additional Mathematics
Grade Gobbler 5

40 Mark Paper

Question 1

A cuboid *ABCDEFGH* measures 7 cm by 4 cm by 3 cm, as shown below.



Calculate, in degrees, the angle *HAC*.
Give your answer accurate to 1 decimal place.

[3 marks]

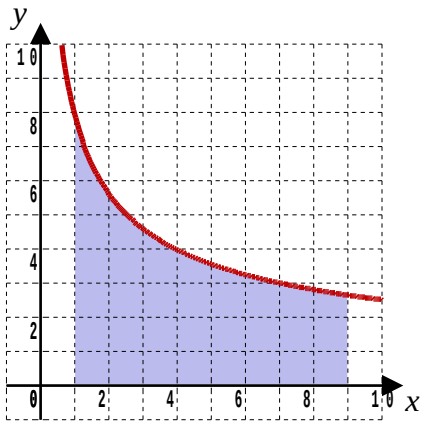
Question 2

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

Determine the value of $f'(3)$

[4 marks]

Question 3



Use integration to find, $\int_1^9 \frac{8}{\sqrt{x}}\, dx$

[4 marks]

Question 4

A circle has equation, $x^2 + y^2 - 8x + 2y + 8 = 0$

(i) Write the circle's equation in the form $(x - a)^2 + (y - b)^2 = r^2$ where a, b and r are constants to be found.

[3 marks]

(ii) Hence, or otherwise, state the coordinates of the circle's centre and its radius.

[2 marks]

Question 5

A quadratic equation of the form $a x^2 + bx + c = 0$

has solutions given by the well known formula, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

(i) Show how to use this formula to find the solutions of;

$$x^2 + x - 1 = 0$$

Give your answers correct to three significant figures.

[4 marks]

The discriminant, D, is the piece of this formulae that is under the square root sign.

i.e. $D = b^2 - 4ac$

(ii) Calculate the discriminant associated with the quadratic equation;

$$x^2 + 8x + 26 = 0$$

[2 marks]

(iii) What does the part (ii) answer tell you about $x^2 + 8x + 26 = 0$?

[1 mark]

Question 6

(a) Use the ${}^{n}C_{r}$ button on your calculator to determine the values of,

(i) ${}^{7}C_{3}$ **(ii)** ${}^{11}C_{7}$ **(iii)** ${}^{16}C_{4}$

[3 marks]

(b) In a very large box of Smarties™, 14% are blue.
In a dark cinema, Charlie eats five Smarties™ without looking at their colour.
Consider the formula;

$$P(\,r \text{ Blue Smarties}^{TM}\,) = {}^{n}C_{r}\, p^{r}\, q^{n-r}$$

In this formula,

n is the number of Smarties™ eaten

r is the number of Blue Smarties™ eaten

p is the probability of a Blue Smartie™ being eaten

q is the probability of a non-Blue Smartie™ being eaten

(i) Calculate the probability that exactly two of the five Smarties™ eaten are blue. Give your answer to three decimal places.

[2 marks]

(ii) Calculate the probability that exactly four of the five Smarties™ eaten is blue. Give your answer to six decimal places.

[2 marks]

(iii) What is the significance of the box of Smarties™ being described as *very large* ?

[1 mark]

Question 7

(a) $v^2 = u^2 + 2as$

Make *s* the subject of the formula.

[1 marks]

(b) A car crosses a speed hump with a velocity of 4 m s^{-1}
It then accelerates at a rate of 2.5 m s^{-2} to a speed of 9 m s^{-1} when the driver applies the brakes, causing an acceleration of – 3 m s^{-2}, reducing the speed of the car to 4 m s^{-1} to cross the next hump.

(i) How far apart are the humps ?

[2 marks]

(ii) How long does the car take to travel from one hump to the next ?

[2 marks]

(iii) The question implies that the car is being modelled as a particle.
In what way does this assumption affect your results ?

[1 mark]

Question 8

$$f(x) = 4x^4 + px^3 + x^2 - 2 \qquad \text{where } p \text{ is a constant}$$

When $f(x)$ is divided by $(2x - 1)$ the remainder is -1.75

By using the remainder theorem, or otherwise, determine the value of p.

[3 marks]