Practice paper (Calculator 2)

Higher Tier

Time: 1 hour 30 minutes

The total mark for this paper is 80
The marks for **each** question are shown in brackets

1 The cost of a tablet computer is reduced by 15% to £258.

Find the price before the reduction.

..... £

[Total: 2 marks]

2 Work out an estimate for $(0.45 \times 0.78)^2$

.....

[Total: 2 marks]

3 Solve the following equations.

a $\frac{2x - 5}{11} = 3$

$x =$ .....

[1 mark]

b $x^2 - x - 42 = 0$

$x =$ .....

[1 mark]

[Total: 2 marks]

4 The line joining points $A(3, 2)$ and $B(-2, k)$ has a gradient of $\frac{4}{5}$

a Find the value of k.

$k =$ .....

[2 marks]

b Find the equation of the line joining *A* and *B*.

.....

[2 marks]

[Total: 4 marks]

5 Solve $x^2 - 3x - 6 = 0$

Give your solutions correct to 2 decimal places.

$x =$ .....

[Total: 4 marks]

6 A curve has the equation $y = x^2 - 2x - 3$

a Find the coordinates of the turning point of the curve.

.....

[4 marks]

b Sketch the curve $y = x^2 - 2x - 3$

Show the coordinates of the turning point and the points where the curve intersects the axes.

[4 marks]

[Total: 8 marks]

7 **a** Solve algebraically the simultaneous equations

$y = 10x^2 - 5x - 2$

$y = 2x - 3$

$x =$ .....

$y =$ .....

[4 marks]

b Write down what your answer represents.

.....

[1 mark]

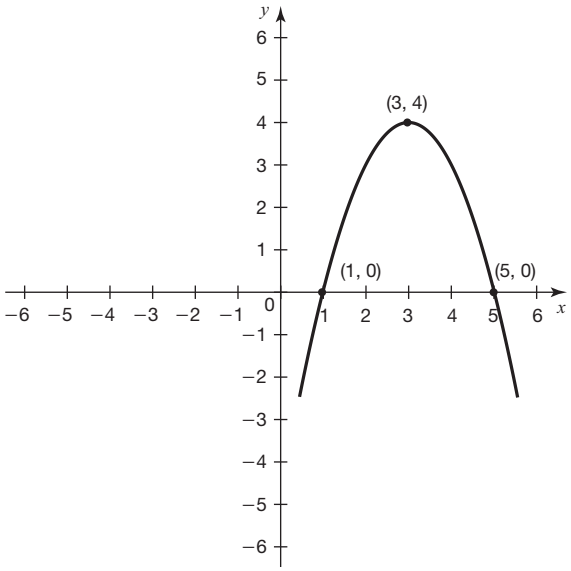
[Total: 5 marks]

8 Show that $\frac{3\sqrt{3} - \sqrt{2}}{\sqrt{3} - \sqrt{2}}$ can be written as $7 + 2\sqrt{6}$

[Total: 4 marks]

9 The diagram shows a sketch of the graph of $y = f(x)$

The graph has a turning point at (3, 4) and intersects the x-axis at the points (1, 0) and (5, 0).



On the same axes, sketch the graph of $y = f(x - 1) + 1$

Label the coordinates of three points on the graph.

[Total: 4 marks]

10 The functions f and g are such that

$f(x) = 5x^2 + 4$ and $g(x) = x + 1$

a Find $f(-2)$

$f(-2) =$ .....

[1 mark]

b Find $f^{-1}(x)$

$f^{-1}(x) =$ .....

[2 marks]

c Find $fg(x)$

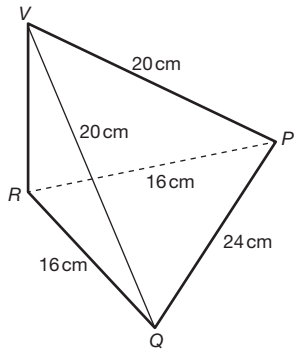
$fg(x) =$ .....

[2 marks]

[Total: 5 marks]

11 In the pyramid *VPQR*, point *V* is directly above point *R*.

VP = *VQ* = 20 cm, *QR* = *PR* = 16 cm and *PQ* = 24 cm.



a Calculate the vertical height *VR*.

..... cm

[2 marks]

b Point *S* is the midpoint of *PQ*.

Find the lengths of *VS* and *RS*.

VS = ... cm

RS = ... cm

[2 marks]

c Find the angle between the line *VS* and the plane *PQR*.

..... °

[2 marks]

[Total: 6 marks]

12 Amy is one third the age of her mother.

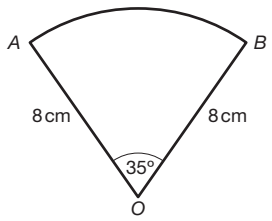
In 12 years' time, Amy will be half the age of her mother.

How old is Amy's mother?

..... years

[Total: 3 marks]

13 *OAB* is a sector of a circle with radius 8 cm.



a Work out the length of arc *AB*.

Give your answer correct to 2 decimal places.

..... cm

[2 marks]

b Work out the area of sector *OAB*.

Give your answer correct to 2 decimal places.

..... cm

[2 marks]

[Total: 4 marks]

14 Show that $\frac{1}{3x^2 + 5x - 2} \div \frac{1}{9x^2 - 1}$ simplifies to $\frac{ax + b}{cx + d}$, where a, b, c and d are integers.

Give the values of a, b, c and d.

$a =$ .....

$b =$ .....

$c =$ .....

$d =$ .....

[Total: 4 marks]

15 Three grandchildren visit their grandparents every 12 days, 16 days and 18 days, respectively.

On one day, they all visit their grandparents.

a What is the minimum amount of time after which two grandchildren will call on the same day?

..... days

[2 marks]

b What is the minimum amount of time after which all three will again call on the same day?

..... days

[2 marks]

[Total: 4 marks]

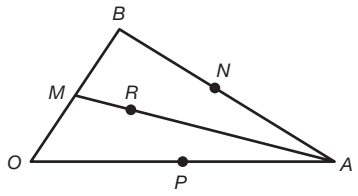
16 *OAB* is a triangle.

M is the midpoint of *OB*.

N is the midpoint of *AB*.

P is the midpoint of *OA*.

R lies on line *AM* such that $AR = 2RM$.



$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

a Work out the following vectors in terms of **a** and **b**.

i $\overrightarrow{AM}$

.....

[1 mark]

ii $\overrightarrow{AR}$

.....

[1 mark]

b Show that *R* lies on line *BP*.

[3 marks]

[Total: 5 marks]

17 A ball is thrown vertically into the air with a speed of v m/s.

The height h m it travels during a time of T seconds is given by the formula

$h = \frac{gT^2}{2}$

$g = 9.8\,\text{m/s}^2$ correct to 2 significant figures

$T = 2.54\,\text{s}$ correct to 3 significant figures

Work out the value of h to a suitable degree of accuracy. Give a reason for your answer.

..... m **[4 marks]**

..... **[1 mark]**

[Total: 5 marks]

18 **a** Prove that the cubic equation $x^3 - 4x + 2 = 0$ has a root between 0 and 1.

[2 marks]

b Show that the equation $x^3 - 4x + 2 = 0$ can be arranged to give $x = \frac{x^3}{4} + \frac{1}{2}$

[1 mark]

c Starting with $x_0 = 0.5$, use the iteration formula $x_{n+1} = \frac{(x_n)^3}{4} + \frac{1}{2}$ to find an estimate for one of the roots of the equation by working out x_4

Give your answer correct to 3 decimal places.

$x_4 =$ ..... **[3 marks]**

[Total: 6 marks]

19 A bag contains only red and blue counters. The ratio of red to blue counters is 4 : 5

a The total number of counters in the bag is 36.

Find the number of red counters in the bag.

.....

[1 mark]

b Two counters are removed from the bag at random.

Find the probability that

i both counters are red

.....

[1 mark]

ii the counters are different colours.

.....

[1 mark]

[Total: 3 marks]