Dr Oliver Mathematics
AQA Further Maths Level 2
June 2021 Paper 1
1 hour 30 minutes

The total number of marks available is 80.

You must write down all the stages in your working.

You are **not** permitted to use a scientific or graphical calculator in this paper.

1. Work out the distance between the points $A(-3, 7)$ and $B(5, 1)$. (2)

2. (3)
$$y = x(2x^4 - 7x^3).$$

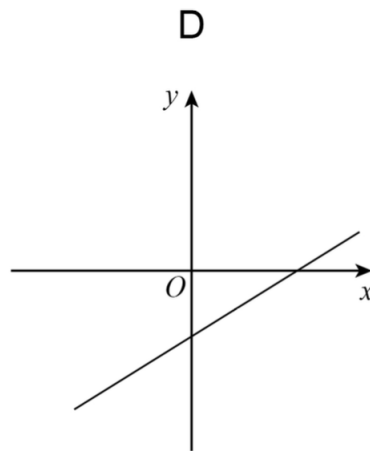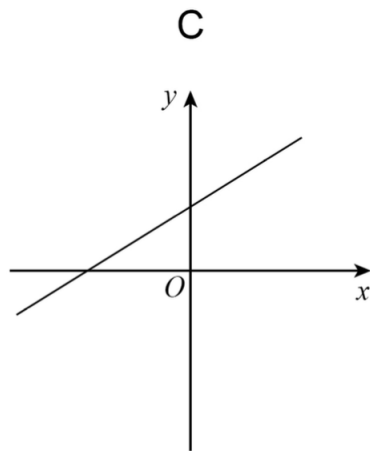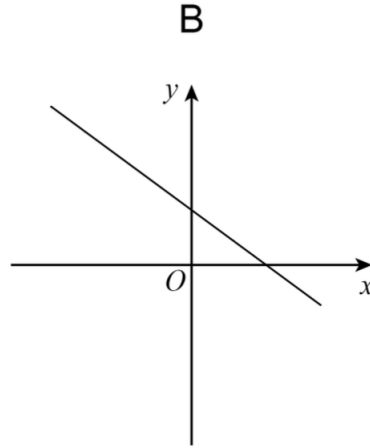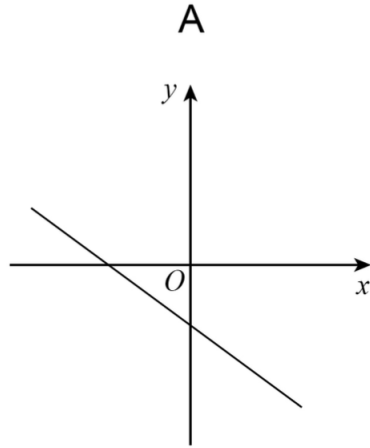   Work out an expression for the rate of change of y with respect to x.

3. Here are four sketch graphs. (1)

A

B

C

D

Circle the letter of the sketch graph that represents

$$3x + 2y = 5.$$

4. The function f is given by

$$f(x) = 3x - 5.$$

The range is

$$13 < f(x) < 19.$$

(a) Work out the domain of the function. (1)

The function g is given by

$$g(x) = x^2 - 4$$

with domain $-1 < x < 3$.

(b) Work out the range of the function. (2)

The function h is given by

$$h(x) = \frac{3+x}{2}.$$

(c) Work out $h^{-1}(x)$. (2)

5. The nth term of a sequence is

$$\frac{2n+47}{n+1}.$$

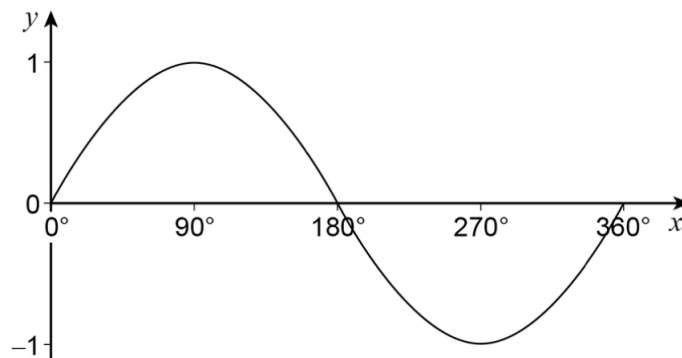A term of the sequence has a value of 5.

(a) Work out the value of n. (2)

(b) Write down the limiting value of the sequence as $n \to \infty$. (1)

6. Here is a sketch of (2)

$$y = \sin x$$

for

$$0° \leqslant x \leqslant 360°.$$

You are given that

$$\sin 220° = -k.$$

Work out the two values of x for $0° \leqslant x \leqslant 360°$ for which $y = k$.

7. Solve (3)

$$2x^2 + 4 > (2x - 3)(x + 1).$$

8. Simplify (2)

$$\sqrt{3}(\sqrt{75} + \sqrt{48}),$$

writing your answer as an integer.

3

9. Expand and simplify fully (3)
$$(2x - 5)(3x - 4)(x + 2).$$

10. The first four terms of a quadratic sequence are (3)

$$0 \quad 1 \quad 0 \quad -3.$$
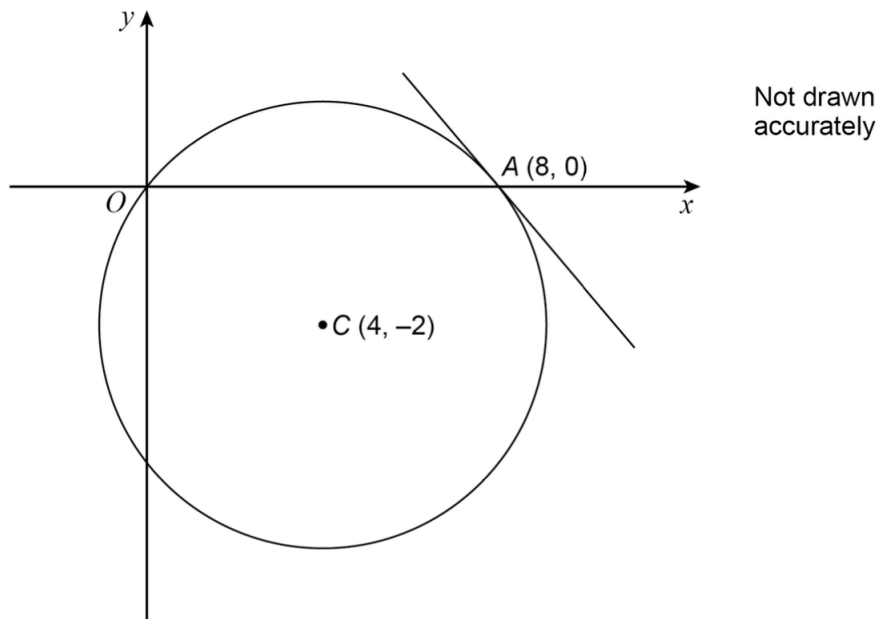
Work out an expression for the nth term.

11. (4)
$$\begin{pmatrix} 2 & 1 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} a & b \\ 0 & 0.4 \end{pmatrix} = k\mathbf{I},$$

where k is a constant and $\mathbf{I}$ is the identity matrix.

Work out the values of a and b.

12. A circle, centre $C(4, -2)$, passes through the origin and point $A(8, 0)$ on the x-axis. The tangent at A is shown.

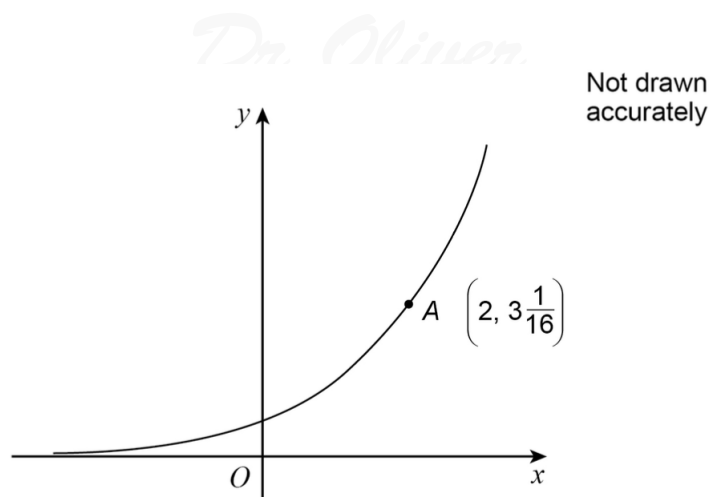Not drawn accurately

(a) Work out the equation of the circle. (2)

(b) Work out the equation of the tangent to the circle at A. (3)

13. Here is a sketch of
$$y = k^x,$$

where $k > 0$.
$A(2, 3\frac{1}{16})$ is a point on the curve.

Not drawn accurately

(a) Work out the value of k. (2)

B is a point on the curve with x-coordinate -1.

(b) Work out the y-coordinate of B. (1)

14. Solve the simultaneous equations: (5)

$$4a - b + 3c = 27$$
$$3a + 2b - c = 5$$
$$2a - 5c = -7.$$

Do **not** use trial and improvement.
You **must** show your working.

15. Work out the value of x where $0° \leqslant x \leqslant 90°$ for which (2)

$$3 \tan^2 x = 1.$$

16.
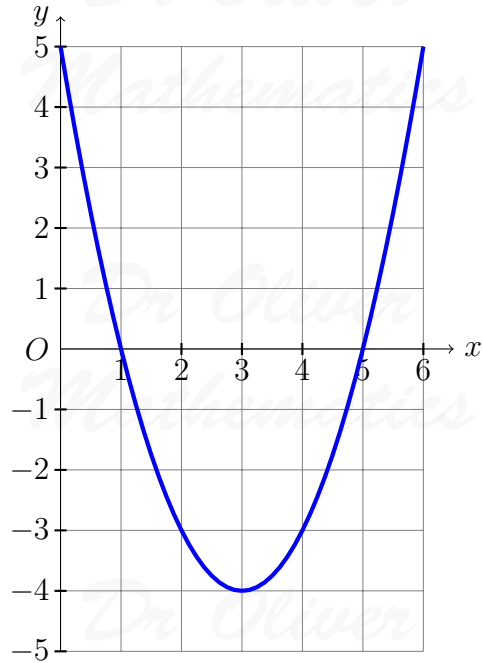$$\mathrm{f}(x) = 200x^3 + 100x^2 - 18x - 9.$$

(a) Use the factor theorem to show that $(2x + 1)$ is a factor of $\mathrm{f}(x)$. (2)

(b) Hence solve $\mathrm{f}(x) = 0$. (3)

17. Here is the graph of (3)
$$y = x^2 - 6x + 5,$$

for values of x between 0 and 6.
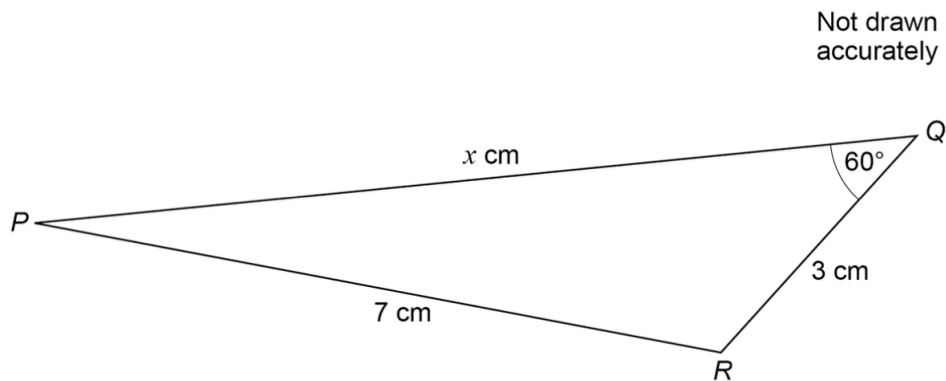
By drawing a suitable **linear** graph on the grid, work out approximate solutions to

$$x^2 - 7x + 9 = 0.$$

18. Here is a triangle.

(4)

Not drawn accurately

Use the cosine rule to work out the value of x.

19. $y = f(x)$ is the graph of a cubic function.
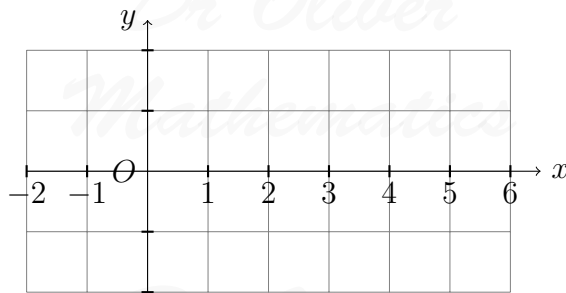
(4)

- $y < 0$ for $x < 5$.
- $y \geqslant 0$ for $x \geqslant 5$.

6

The function is

- increasing for $x < -1$,
- decreasing for $-1 < x < 2$, and
- increasing for $x > 2$.

Draw a possible sketch of $y = \mathrm{f}(x)$ for values of x from -2 to 6.

20. Miriam's date of birth is 14/09/2006. (3)

She makes a 4-digit number code using digits from her date of birth.

The 4-digit number she makes must

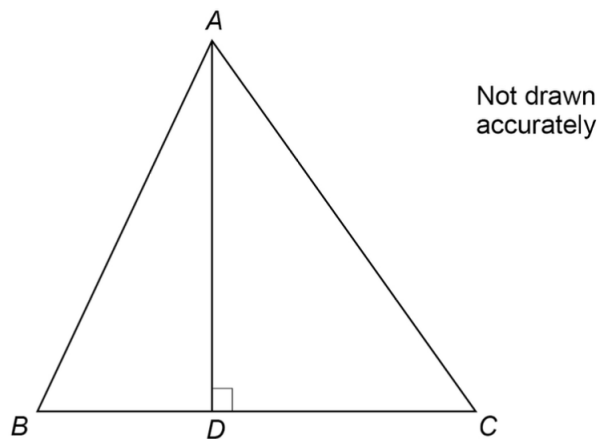- not start with 0 and
- have all different digits.

How many codes can she make?

21. ABC is a triangle. (5)
The perpendicular from A meets BC at D.
$BC = (6 + 2\sqrt{7})$ cm.

A

Not drawn
accurately

B   D   C

7

Area of triangle $ABC = (13 + 3\sqrt{7})$ cm^2.

Work out the length, in cm, of AD.
Give your answer in the form
$$a + b\sqrt{c},$$
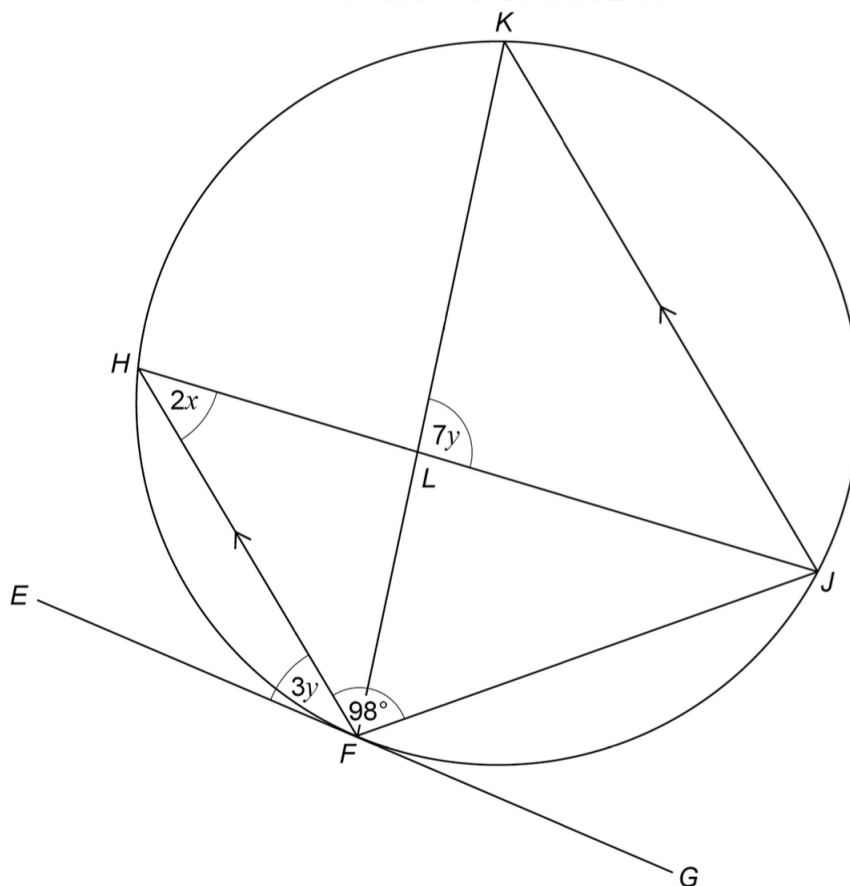where a, b, and c are integers.

22. Solve (4)
$$8^x = \frac{2^{56} - 4^{26}}{30}.$$

23.
- F, H, K, and J are points on a circle.
- Chords HJ and KF intersect at L.
- EFG is a tangent to the circle.
- FH and JK are parallel.

Not drawn
accurately

Angle $FHJ = 2x$.

(a) Give reasons why angle FKJ and angle HJK are also equal to $2x$. (2)

(b) Work out the values of x and y. (4)
You **must** show your working.
Do **not** use trial and improvement.