1.

    a. Expand $(3 + x)^4$ fully.

        (2)

    b. Hence find the exact value of 1003^4

        (2)

2.

    a. Show that $(x - 3)$ is a factor of $f(x) \equiv 2x^3 - 5x^2 - 7x + 12$

        (1)

    b. Factorise $f(x)$

        (2)

    c. Find the exact solutions of
        i. $f(x) = 0$

        (1)

        ii. $f(x + 2) = 0$

        (1)

3.

$A = (-2, 6),\ B = (-1, -1)$ and $C = (5, 5)$

    a. Find the gradient of line AB

        (1)

    b. Find the midpoint M of A and B

        (1)

    c. Find the equation of the perpendicular bisector of AB in the form of $y = mx + c$

        (2)

    d. Find the equation of the perpendicular bisector of BC

        (2)

    e. Find the intersection of the perpendicular bisector of AB and BC

        (2)

Given points A, B and C passing through the circle P,

    f. Hence find the equation of the circle in the form of
        $(x - a)^2 + (y - b)^2 = r^2$

    where *a, b* and *r* constants to be found.

        (3)

4.

   a. Shade the region R for the inequalities below

$$y \leqslant 2x + 1$$
$$x \leqslant 2$$
$$y \geqslant -1$$

(3)

   b. Find the area of region R.

(1)

5.

$$f(x) = 1 - \frac{x}{2}$$
$$g(x) = 5x - 2 - 2x^2$$

   a. Sketch on the same axes for $y = f(x)$ and $y = g(x)$

(5)

   b. Hence solve the inequality for $f(x) \leqslant g(x)$

(1)

6.

" $3^n + 2$ is a prime number for all positive integers n"

Disprove this statement.

(2)

7.

$$\frac{9^{x-2}}{3} = \frac{81^y}{27^x}$$

Find y in terms of x

(3)

8.

$$f(x) = \left(2 - \frac{x}{k}\right)^8$$

  a. Find the coefficient of x^3 in terms of k
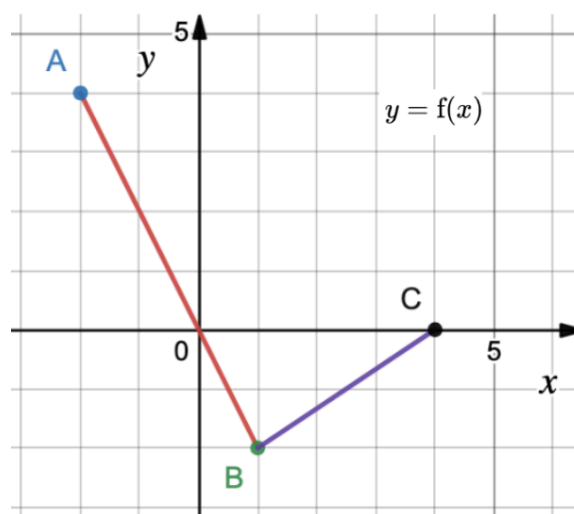
                                (2)

$$g(x) = (2 + 3x)\left(2 - \frac{x}{k}\right)^8$$

Given $k = 1$

  b. Find the the value of the coefficient of x^2 of $g(x)$

                                (4)

9.

The graph of $y = f(x)$ consists of 2 line segments between $A(-2, 4)$ and $B(1, -2)$ and between B and $C(4, 0)$

  a. Find the length of AB, AC and BC

                                (3)

  b. Find $\angle BAC$ correct to 1 decimal place

                                (3)

  c. Find the exact value of the area of $\triangle ABC$

                                (3)

  d. Hence find the shortest distance between from point B to line AC
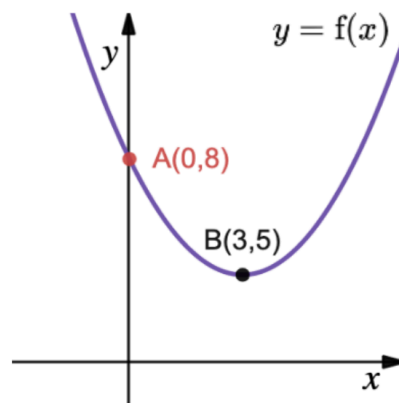
                                (1)

10.

Find the range of values of k such that the line $y = x + k$ cuts the circle $(x + 2)^2 + y^2 = 8$ at two distinct points.

                                (4)

11.

The graph of $y = \mathrm{f}(x)$ is shown in fig 3. It cuts the y axis at $A(0, 8)$ and has a minimum point at $B(3, 5)$

    a.   Sketch on separate axes the graphs of

        i. $y = \mathrm{f}(2x)$

        ii. $y = 3 + \mathrm{f}(-x)$

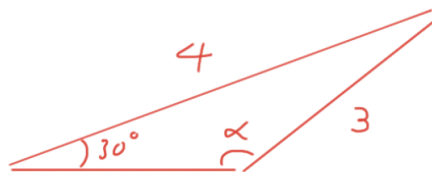   giving the coordinates of the points to which A and B are transformed.

(6)

The graph of $y = a + \mathrm{f}(x + b)$ has a minimum point at the origin.

    b.   Find the values of a and b

(2)

12.

Given α is an obtuse angle, find α in degrees correct to 1 decimal place

(4)