ANSWER ALL QUESTIONS, MAKE SURE YOU SHOW ALL WORKING OTHERWISE YOU WILL NOT BE AWARDED MARKS. IF YOU WRITE ON ANY OTHER PAPER, PLEASE HAND THIS IN WITH THE SHEET.

1. $3x^2 - 6x + 7$	2. Write $-x^2 + 5x + 9$	3. Given that $ 64^p = 4$	^{4. Write} $9^8 \times 3^{19}$ in the form 3^k	5. Solve the inequality $z(2z-5)>3$
Write the expression in the form $r(x + p)^2 + q$	in the form $a(x+b)^2 + c$	find the value of p.	Where k is an integer.	
where p, q and r are integers.	where a, b and c are rational numbers.			
6. Express $\sqrt{50} - \frac{4}{\sqrt{2}}$ in the form $a\sqrt{2}$ Where a is an integer to be found.	7. Solve the equation $2z^6 - 9z^3 + 9 = 0$	8. Solve the simultaneous equations x + 2y = 6 $x^2 + y^2 = 8$	9. Given that $g(x) = 5x - 3$, find $g^{-1}(x)$	10. Given that $g(x) = \frac{4x}{3} - 5$, find $g^{-1}(x)$
11. Find z (1dp) 99° 2 37° 10 cm	12. Find x (1dp) 11 cm x	13. Find x (1dp) 6 cm	14. Angle z is obtuse, find z (1dp)	15. Find x (2dp)
16. Find z (1dp) 14 cm 16 cm 16 cm	17. Find x (2dp)	18. Find the area of the triangle (1dp) 16 cm A^{C} B^{C} A^{D} B^{C} B^{C} A^{D} B^{C} B^{C} A^{D} B^{C} B^{C} B^{C} A^{D} B^{C} B^{C} A^{D} B^{C}	19. Find the area of the triangle (1dp) R R R R R R R R	20. Find x, given the area is 65cm^2

Mark scheme

Question 1

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

① Factorise the first two terms by 3.

$$3x^2 - 6x + 7 = 3(x^2 - 2x) + 7$$

② Complete the square.

$$= 3((x-1)^2 - 1) + 7$$

 $\ensuremath{\textcircled{3}}$ Expand and simplify.

$$= 3 (x - 1)^{2} - 3 + 7$$

= 3 (x - 1)² + 4

Question 2

 $-\left(x-\frac{5}{2}\right)^2+\frac{61}{4}$

The the terms of -1 out of the first two terms.

 $-x^2 + 5x + 9 = -[x^2 - 5x] + 9$

O Complete the square on the first two terms.

$$-[x^{2}-5x]+9 = -\left[\left(x-\frac{5}{2}\right)^{2}-\frac{25}{4}\right]+9$$

③ Expand the square brackets and simplify.

$$-\left[\left(x-\frac{5}{2}\right)^2 - \frac{25}{4}\right] + 9$$
$$= -\left(x-\frac{5}{2}\right)^2 + \frac{25}{4} + 9$$
$$= -\left(x-\frac{5}{2}\right)^2 + \frac{61}{4}$$

Question 3

$$p = \frac{1}{3}$$

$$64^p = 4$$

 $64^p = 64^{\frac{1}{3}}$

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Therefore $p = \frac{1}{3}$

Question 4

3³⁵

Change the base for each factor.

$$9^8 \times 3^{19}$$

= $(3^2)^8 \times 3^{19}$

② Simplify.

$$= 3^{16} \times 3^{19} \\ = 3^{35}$$

Question 5

$$z < -\frac{1}{2} \text{ or } z > 3$$

Expand the brackets and make one side of the inequality 0.

$$z(2z-5) > 3$$

 $2z^2 - 5z > 3$
 $2z^2 - 5z - 3 > 0$

^② Factorise and find the critical values.

$$(2z+1)(z-3) > 0$$

 $z = -\frac{1}{2}$ or $z = 3$

③ To solve (2z+1)(z-3) > 0, sketch y = (2z+1)(z-3), then consider where y > 0



Therefore & nbsp z 3

Question 6

 $3\sqrt{2}$

① Simplify $\sqrt{50}$ and rationalise $\frac{4}{\sqrt{2}}$

$$\sqrt{50} - \frac{4}{\sqrt{2}} = \sqrt{25} \sqrt{2} - \frac{4\sqrt{2}}{\sqrt{2}\sqrt{2}} = 5\sqrt{2} - \frac{4\sqrt{2}}{2} = 5\sqrt{2} - \frac{4\sqrt{2}}{2} = 5\sqrt{2} - 2\sqrt{2}$$

② Collect like terms.

 $= 3\sqrt{2}$

Question 7

$$z = \sqrt[3]{3} \text{ or } z = \sqrt[3]{\frac{3}{2}}$$

①Make a substitution:Let $y = z^3$, $2y^2 - 9y + 9 = 0$ **②Solve the quadratic:**

 $y = 3, \frac{3}{2}$ ③Reverse the substitution:Since $y = z^3$, we get: $z^3 = 3$ or $z = \sqrt[3]{3}$ $z = \sqrt[3]{\frac{3}{2}}$ Question 8

Question 8

 $x = 2, y = 2 \text{ or } x = \frac{2}{5}, y = \frac{14}{5}$

Rearrange x + 2y = 6 to make y the subject.

$$x + 2y = 6$$

$$2y = 6 - x$$

$$y = \frac{6 - x}{2}$$

Substitute $y = \frac{6-x}{2}$ into $x^2 + y^2 = 8$ then solve.

$$x^{2} + \left(\frac{6-x}{2}\right)^{2} = 8$$

$$x^{2} + \frac{(6-x)(6-x)}{4} = 8$$

$$4x^{2} + (6-x)(6-x) = 32$$

$$4x^{2} + 36 - 6x - 6x + x^{2} = 32$$

$$5x^{2} - 12x + 36 = 32$$

$$5x^{2} - 12x + 4 = 0$$

$$\therefore x = 2 \text{ or } x = \frac{2}{5}$$

Substitute these values into x + 2y = 6

When
$$x = 2$$
, $1(2) + 2y = 6$
 $y = 2$
When $x = \frac{2}{5}$, $1\left(\frac{2}{5}\right) + 2y = 6$
 $y = \frac{14}{5}$

Question 9

 $\frac{x+3}{5}$

Replace g(x) by y and make x the subject.

$$g(x) = 5x - 3$$

$$y = 5x - 3$$

$$y + 3 = 5x$$

$$\frac{y+3}{5} = x$$

Interchange x and y and then replace y by $g^{-1}(x)$

$$\frac{x+3}{5} = y$$

 $g^{-1}(x) = \frac{x+3}{5}$

Question 10

 $\frac{3(x+5)}{4}$

Replace g(x) by y and make x the subject.

$$g(x) = \frac{4x}{3} - 5$$
$$y = \frac{4x}{3} - 5$$
$$y + 5 = \frac{4x}{3}$$
$$3(y + 5) = 4x$$
$$\frac{3(y+5)}{4} = x$$

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Interchange x and y and then replace y by $g^{-1}(x)$

$$\frac{3(x+5)}{4} = y$$
$$g^{-1}(x) = \frac{3(x+5)}{4}$$

Question 11

z =6.1cm

Using the sine rule, $\frac{z}{\sin 37} = \frac{10}{\sin 99}$

By rearranging:

$$z = \frac{10}{\sin 99} \times \sin 37$$
$$= \frac{10 \sin 37}{\sin 99}$$
$$= 6.1$$

Question 12

x =12.4cm

① Use the formula for the cosine rule.

$$a^{2} = b^{2} + c^{2} - 2bc \cos A$$

$$x^{2} = 11^{2} + 12^{2} - 2 \times 11 \times 12 \times \cos 65$$

② Square root and calculate.

$$x = \sqrt{11^{2} + 12^{2}} - 2 \times 11 \times 12 \times \cos 65$$

x = 12.4 cm

Question 13

x =39.7 °

Using the sine rule,
$$\frac{\sin x}{5} = \frac{\sin 50}{6}$$

Multiply both sides by 5

$$\sin x = \frac{\sin 50}{6} \times 5$$
$$= \frac{5 \sin 50}{6}$$
$$x = \sin^{-1} \left(\frac{5 \sin 50}{6}\right)$$
$$x = 39.7^{\circ}$$

Question 14

z = 101.8°

Taking z'as an acute angle, using the sine rule, $\frac{\sin z'}{14} = \frac{\sin 39}{9}$

Multiply both sides by 14

$$\sin z' = \frac{14 \times \sin 39}{9}$$
$$z' = \sin^{-1} \left(\frac{14 \times \sin 39}{9}\right)$$
$$z' = 78.2^{\circ}$$
$$z = 180 - 78.2 = 101.8^{\circ}$$

Question 15

x =5.04cm



① Use the Cosine Rule to find y, opposite of 46 $^{\circ}$

$$a^{2} = b^{2} + c^{2} - 2bc \cos A$$

$$y^{2} = 8.3^{2} + 7.9^{2} - 2 \times 8.3 \times 7.9 \times \cos 46$$

$$y^{2} = 40.2025 \dots$$

$$y = \sqrt{40.2025 \dots}$$

$$y = 6.3405 \dots$$

② Once you know y, use the sine rule to find x

$$\frac{x}{\sin 40} = \frac{6.3405}{\sin 54}$$
$$x = \frac{6.3405}{\sin 54} \times \sin 40$$
$$x = 5.04cm$$

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Question 16

z =75.5 °

0 Use the formula for the cosine rule.

$$a^{2} = b^{2} + c^{2} - 2bc \cos A$$

 $16^{2} = 12^{2} + 14^{2} - 2 \times 12 \times 14 \times \cos z$

② Make cos z the subject.

$$\cos z = \frac{12^2 + 14^2 - 16^2}{2 \times 12 \times 14}$$
$$z = \cos^{-1} \left(\frac{12^2 + 14^2 - 16^2}{2 \times 12 \times 14} \right)$$
$$= 75.5^{\circ}$$

Question 17

x =2.96cm



Use the Sine Rule to find y

$$\frac{y}{\sin 60} = \frac{6.1}{\sin 76}$$
$$y = \frac{6.1}{\sin 76} \times \sin 60$$
$$y = 5.4445 \dots$$

O Once you know y, use the Cosine Rule to find x

$$a^{2} = b^{2} + c^{2} - 2bc \cos A$$

$$x^{2} = 5.6^{2} + 5.4445^{2} - 2 \times 5.6 \times 5.4445 \times \cos 31$$

$$x^{2} = 8.7339 \dots$$

$$x = 2.96cm$$

Question 18

120.8cm²

Area = $\frac{1}{2} \times 20 \times 16 \times \sin 49$ = 120.8 cm²

Question 19

157.8cm²

• Calculate $\angle QRP$ using the sine rule.

$$\frac{\sin(\angle QRP)}{19} = \frac{\sin(54)}{18}$$
$$\sin(\angle QRP) = \frac{19\sin(54)}{18}$$
$$\angle QRP = \sin^{-1}(\frac{19\sin(54)}{18})$$
$$= 58.6$$

• Calculate $\angle RPQ$

$$\angle RPQ = 180 - 54 - 58.6$$

= 67.4

• Calculate the area using $\frac{1}{2}ab\sin C$

Area
$$=\frac{1}{2} \times 19 \times 18 \times \sin 67.4$$

= 157.8 cm²

Question 20

38.2 [°]

 Substitute in the formula.

$$A = \frac{1}{2}ab\sin C$$

65 = $\frac{1}{2} \times 15 \times 14 \sin x$

② Solve.

$$\frac{\frac{65}{\frac{1}{2} \times 15 \times 14}}{x} = \sin x$$
$$x = \sin^{-1} \left(\frac{\frac{65}{\frac{1}{2} \times 15 \times 14}}{x}\right)$$
$$= 38.2^{\circ}$$