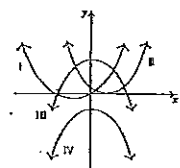


Q1 | What is the least possible value of  $a$  if  $\frac{-a}{10} < \frac{1}{2}$ , given that  $a$  is an integer?

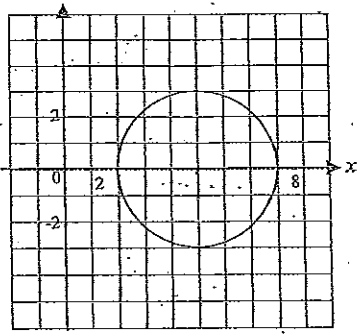
Q2 | What is one half of  $8^{10}$ ?  
Leave your answer in simplified index form

Q3 | Match the graphs with their equations.



- (A)  $y = -x^2 - 2$
- (B)  $y = x(x+3)$
- (C)  $y = (x-1)^2$
- (D)  $y = -x^2 + 4$

Q4 | The circle shown has equation:



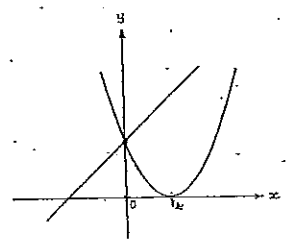
Q5

For the circle with equation  $x^2 + y^2 + 6x - 8y = 0$

- i) Find the centre of the circle.
- ii) Show that the origin is on the circle.
- iii) If the origin is one end of a diameter of the circle, find the coordinates of the other end point.

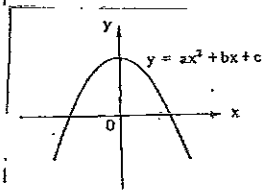
Q6

On the right are the graphs of  $y = (x-c)^2$  and  $y = x+t$ . Write down the most *simplified* relationship between  $c$  and  $t$ .



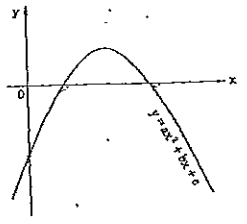
Q7

The graph of  $y = ax^2 + bx + c$  is represented by the graph as shown below. The vertex is positioned on the y-axis. Draw a graph of  $y = cx^2 + bx + a$



Q8

The graph below is that of  $y = ax^2 + bx + c$ .



Explain why  $b > 0$ .

Q9

One side of a square, of length  $x$  cm, is lengthened by 4 cm and the adjacent side is decreased by 1 cm. The area of the resulting rectangle exceeds the area of the original square by  $14 \text{ cm}^2$ . An algebraic expression which could be solved to find the length of the square?

Q10

Find the points of intersection of:

$$y = x^2 + 6x - 21 \text{ and } y = 15 - 3x$$

Q11

Substitute  $X = \frac{1}{a}$  into  $\frac{a}{X} + 3X$ , then simplify.

Q12

$$\text{Solve } (3^x)^2 - 10(3^x) + 9 = 0.$$

Q13

Determine the value of  $c$  if

$$(12x + r)^2 = 144x^2 + 168x + c$$

is true for all values of  $x$ .

Q14

If the graphs of  $y = x^2 + 4$  and  $x^2 + y^2 = 16$  are drawn on the same set of axes, how many points, if any, would these two curves have in common?

Justify.

Q15

If  $n = 8 - x$  solve  $n^2 + 2xn = 0$  for  $x$ .

Q16

If  $x + y = a$  and  $\frac{1}{x} + \frac{1}{y} = b$  where  $x, y > 0$ ,

Show that  $(x - y)^2 = \frac{ba^2 - 4a}{b}$

Q17

If  $y = \sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}}$  then find the simplest expression for  $y^2$ .

Q18 In the equation  $a = \frac{1}{\sqrt{12 - b - b^2}}$  what are the possible values for  $b$ ?

**PARTIAL SOLUTIONS**

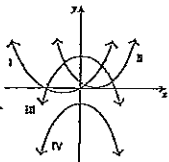
Q1 | What is the least possible value of  $a$  if  $\frac{-a}{10} < -\frac{1}{2}$ ,  
given that  $a$  is an integer?

$a = 6$  ✓

Q2 | What is one half of  $8^{100}$ ?  
Leave your answer in simplified index form

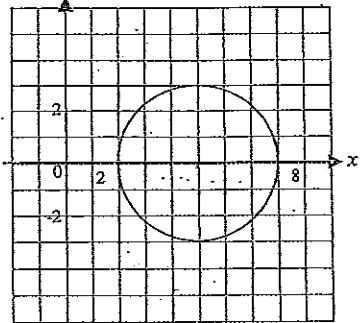
$(2)^3 \times 100 = 2^{300} \times 2^{-1} = 2^{299}$  ✓

Q3 | Match the graphs with their equations.



- (A)  $y = -x^2 - 2$  IV
- (B)  $y = x(x+3)$  I
- (C)  $y = (x-1)^2$  II
- (D)  $y = -x^2 + 4$  III

Q4 | The circle shown has equation:



$(x-5)^2 + (y)^2 = 9$  ✓

Q5 | For the circle with equation  $x^2 + y^2 + 6x - 8y = 0$

- i) Find the centre of the circle.  $(x^2 + 6x + 9) + (y^2 - 8y + 16) = 0 + 9 + 16$   
 $(-3, 4)$
- ii) Show that the origin is on the circle.  $(x+3)^2 + (y-4)^2 = 25$
- iii) If the origin is one end of a diameter of the circle, find the coordinates of the other end point.

i)  $(-3, 4)$  ✓

$0, 0$

$(0+3)^2 + (0-4)^2 = 25$

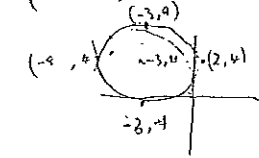
ii)

$(0)^2 + (-4)^2 = 25$  ✓

$\therefore (0, 0)$  is on the circle

iii)

$(-6, 8)$



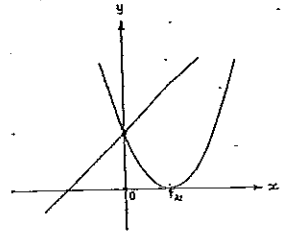
$10 = \sqrt{(x-0)^2 + (y-0)^2}$

$100 = x^2 + y^2$

Q6

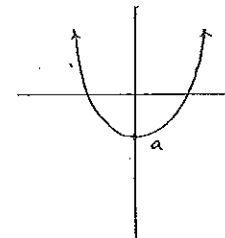
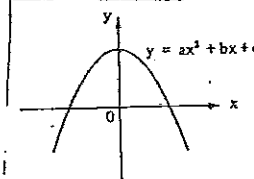
On the right are the graphs of  $y = (x-c)^2$  and  $y = x+t$   
Write down the most simplified relationship between  $c$  and  $t$ .

*to find c is plus time  
cut the  
# sign how?  
 $-c^2 = +$  (1)*



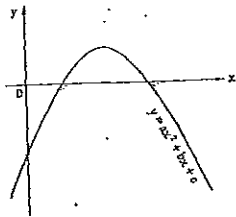
Q7

The graph of  $y = ax^2 + bx + c$  is represented by the graph as shown below.  
The vertex is positioned on the y-axis.  
Draw a graph of  $y = cx^2 + bx + a$



Q8

The graph below is that of  $y = ax^2 + bx + c$ .



$-ax^2 + bx - c$

Explain why  $b > 0$ .

$a = \text{negative}$

$c = \text{negative}$

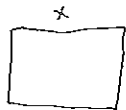
$b$  has to be  $> 0$

because  $a$  is negative and  $c$  is negative

(1)

Q9

One side of a square, of length  $x$  cm, is lengthened by 4 cm and the adjacent side is decreased by 1 cm. The area of the resulting rectangle exceeds the area of the original square by  $14 \text{ cm}^2$ . An algebraic expression which could be solved to find the length of the square?



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

$x^2 = x + 4x - 4$

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

Q10 Find the points of intersection of:

$y = x^2 + 6x - 21$  and  $y = 15 - 3x$

$x^2 + 6x - 21 = 15 - 3x$

$x^2 + 9x - 36$

$(x+12)(x-3)$

$x = (-12, 3)$

P.O.I =  $(-12, -21)$

$(3, 6)$

(1)

Q11

Substitute  $X = \frac{1}{a}$  into  $\frac{a}{X} + 3X$ , then simplify.

$\frac{1}{\frac{1}{2}} = \frac{2}{1}$

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

$\frac{2}{1} + \frac{3a}{1}$

$\frac{2a}{1} + \frac{3a}{1}$

$\frac{2a^2 + 3a}{a}$

✓

Q12

Solve  $(3^x)^2 - 10(3^x) + 9 = 0$ .

$9^{x+2} - 10(3^x) + 9 = 0$

Let  $3^x = x$

$x^2 - 10x + 9 = 0$

$(x-9)(x-1)$

$x = 9, 1$

$(3^x - 9)(3^x - 1) = 0$

32 =

$x = 2, 0$

✓

Q13

Determine the value of  $c$  if

$(12x+r)^2 = 144x^2 + 168x + c$

is true for all values of  $x$ .

$(12x+r)(12x+r)$

$(12x+7)(12x+7)$

$144x^2 + 12x(7) + 12x(7) + 7^2$

$+ 24x(7)$   
 $r = 7$

$c = r^2$

$c = 49$

✓

Q14

If the graphs of  $y = x^2 + 4$  and  $x^2 + y^2 = 16$  are drawn on the same set of axes, how many points, if any, would these two curves have in common?

Justify.

$y^2 = 16 - x^2$

$y = 4 - x$

$y = x^2 + 4$

$(0, 4)$

(1)

$4 - x = x^2 + 4$

$x^2 - x = 0$

$x(x-1) = 0$

✓

Q15

If  $n = 8 - x$  solve  $n^2 + 2xn = 0$  for  $x$ .

$$(8-x)(8-x)^2 + 2x(8-x) = 0$$

$$64 - 16x + x^2$$

$$(x^2 - 16x + 64) + (16x - 2x^2) = 0$$

$$-x^2 + 64 = 0$$

$$-(x^2 - 64) = 0$$

$$(x+8), (x-8) = 0$$

$$x = -8$$

(1)

Q16

If  $x+y=a$  and  $\frac{1}{x} + \frac{1}{y} = b$  where  $x, y > 0$ ,

Show that  $(x-y)^2 = \frac{ba^2 - 4a}{b}$

$$\frac{y}{xy} + \frac{x}{xy} = b$$

$$(x-y)(x+y) = \frac{\left(\frac{y+x}{xy}\right)(x+y)^2 - 4(x+y)}{\frac{y+x}{xy}}$$

$$x^2 - 2xy + y^2 = \frac{(y+x)}{xy} \times (x^2 + 2xy + y^2)$$

$$\frac{yx^2 + 2xy^2 + y^3 + x^3 + 2x^2y + y^2x}{xy}$$

$$\frac{x^3 + 3x^2y + 3xy^2 + y^3}{xy} - \frac{(4x+y)(xy)}{xy}$$

$$(x^2 - 2xy + y^2)(xy) = x^3 - x^2y - y^2x + y^3$$

Q17

If  $y = \sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}}$  then find the simplest expression for  $y^2$ .

$$y^2 = \left( \sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} \right)^2 \left( \sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} \right)$$

$$= \frac{x}{1-x} + 2(1-x) + \frac{1-x}{x}$$

X

Q18 In the equation  $a = \frac{1}{\sqrt{12-b-b^2}}$  what are the possible values for  $b$ ?

X