

F4 Mathematics Supplementary Exercise

Chapter One Quadratic Equations in One Unknown (I)

1. State whether the following numerical expressions are irrational or irrational numbers:
 - (i) $3.1416 + 0.1\dot{6}$ (ii) $\cos(60^\circ) + \sin(30^\circ)$ (iii) $\cos(30^\circ) - \sin(60^\circ)$
 - (iii) $\sqrt{11} + \frac{\sqrt{121}}{5}$ (iv) $\frac{1}{\pi} \left(\frac{3}{4}\pi + \frac{6}{5}\pi \right)$

2. Identify which of the following numbers in (a) – (d) below is/are
 - (i) integer(s)?
 - (ii) rational number(s) but not integer(s)?
 - (iii) irrational number(s)?
 - (iv) non – real number(s)?
 - (a) $(3 + \sqrt{2})(6 - 2\sqrt{2})$ (b) $\sqrt{2 + \sqrt{2}}$ (c) $\sqrt{-2 - \sqrt{2}}$
 - (d) $\sqrt{\sin 30^\circ}$ (e) $\frac{\cos 30^\circ}{\tan 30^\circ}$

3. Given that a is a positive rational number, state whether $\sqrt{(3a - \frac{5}{2})(3a + \frac{5}{2}) + \frac{25}{4}}$ is a rational number(s).

4. Solve $5(x - 0.2) = 3 + 2(0.4x + 1)$

5. Solve $2(4x - 1) + 2(2 - x) = 3(1 - 2x) - 2(x - 2)$

6. Factorize $30 - 25m^2 - 5m$

7. Factorize $15m(m - 3) + 4(2m + 5)$

8. Solve $(5x + 2)(2x - 5) = 0$.

9. Solve $(2x - 1)(3x + 1) = (2x - 1)(3x + 4)$

10. Solve $(4x - 1)^2 = 5$.

11. Solve $(2x - 1)^2 = (5 - 3x)^2$.

12. Solve $x^2 - 5x - 4 = 0$ by completing square. Leave the answer in surd form.

13. Solve $2x^2 - 3 = 5x - 1$ by completing square. Leave the answer in surd form.

14. Solve $-3x^2 - 10x - 5 = 0$ by quadratic formula.

15. Solve $\sqrt{3}x^2 - 6x + 2\sqrt{3} = 0$.

16. Solve $-\frac{2}{3}x^2 = \frac{1}{5}x - \frac{1}{15}$.

17. Solve $2(x - 4)(x + 3) = x - 13$.

18. Solve $10\left(x - \frac{4}{5}\right)\left(\frac{5x}{2} - 2\right) = 169$.

19. Solve $(2x - 1)^2 + (x + 3)^2 = 0$.

20. (a) Given $t = x + \frac{1}{x}$, find t^2 in terms of x , hence find $x^2 + \frac{1}{x^2}$ in terms of t .

(b) Using (a) to convert the equation

$$2x^2 - 9x + 14 - \frac{9}{x} + \frac{2}{x^2} = 0 \text{ -----} (*)$$

into a quadratic equation in terms of t

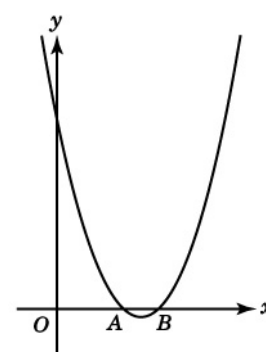
(c) Using the quadratic equation obtained in (b) to solve the equation (*).

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Chapter One Quadratic Equations in One Unknown (II)

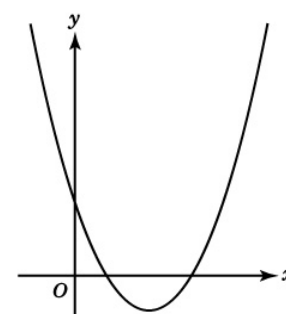
- Evaluate the discriminant of the following quadratic equations and hence determine the nature of the roots for each of the following equations.
 - $5 + 9x^2 - 4x = 0$
 - $4x^2 + 25 = 20x$
 - $x^2 - 5\sqrt{3}x - 4 = 0$
- Find the value of k if the expression $9x^2 + 5x + k$ has perfect square.
- Show that the equation $x^2 - 6cx + 12c^2 = 0$ has no real roots for any value of c .
- Find the value(s) of a if the equation $2x^2 + 5x - a = 0$ has equal roots.
- Given the quadratic equation $x^2 - kx + k = 0$. Find the positive value of k if the quadratic equation has equal roots.
- Given the graph $y = cx^2 - 3x + 4$. Find the value of c if the graph touches the x -axis.
- Find the value of c in the equation $cx^2 - 3x + 4 = 0$ if one root is three times the other
- If $2x^2 + 4x + b = 5$ has no real roots, find the range of values of b .
- If $x^2 + 3x - 4 = m$ has two distinct real roots, find the range of values of m .

- In the figure, the graph of $y = (x - 2)(x - 3)$ cuts the x -axis at A and B . Find $OA + OB$.



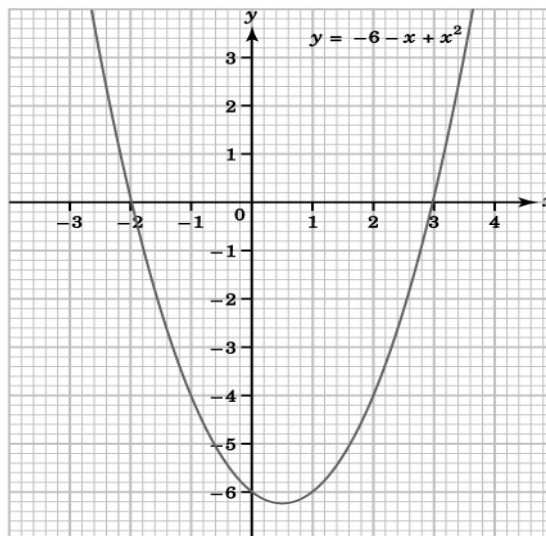
- The figure shows the graph of $y = ax^2 + bx - c$. Which of the following is/are true?

- $b^2 - 4ac > 0$
- $b^2 - 4ac < 0$
- $b^2 + 4ac > 0$
- $b^2 + 4ac < 0$



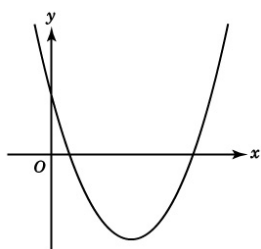
12. The figure below shows the graph of $y = -6 - x + x^2$. Use the graph to solve the following equations:

- (a) $-6 - x + x^2 = 0$
 (b) $-6 - x + x^2 = -4$
 (c) $-6 - x + x^2 = 2$

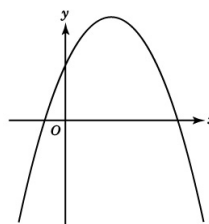


13. Which of the following may represent the graph of $y = -8x^2 + 4x - 2$?

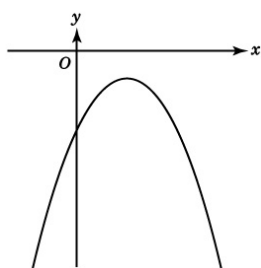
A.



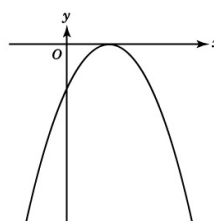
B.



C.



D.

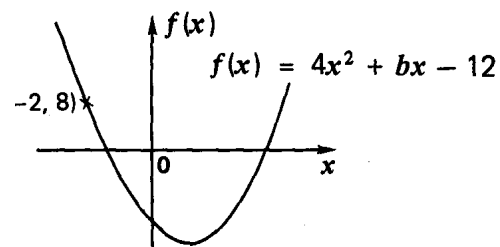


14. A two-digit number is larger than the product of its digits by 40. If the digit in the ten's place exceeds the digit in the units' place by 2, find the number.
15. A copper wire of length 20 cm is cut into two parts. Each part is bent to form a square. If the total area of the two squares formed is 17 cm^2 , find the length of the two parts of the wire.

16. The speed of train A is 20 km per hour faster than that of train B . The time required by train A to travel 360 km is 2 hours less than that required by train B to travel 250 km. Find the speeds of the two trains.
17. The product of two consecutive odd numbers is greater than the number in between by 19. Find all the three numbers.

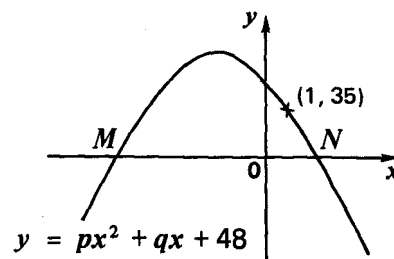
18. In the figure, the graph of $y = 4x^2 + bx - 12$ passes through the point $(-2, 8)$.

- (a) Find the values of b .
- (b) Find the values of x for which $y = 0$.
- (c) Find the range of x for which $y < 0$.



19. In the figure, the graph of $y = px^2 + qx + 48$ cuts the x -axis at M and N , and passes through the point $(1, 35)$. If the coordinates of M is $(-4, 0)$,

- (a) find the coordinates of N ,
- (b) find the range of x for which $px^2 + qx + 48 > 0$.



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