1 **(a)** Solve $\sqrt{3x+22} = x+4$. [3]

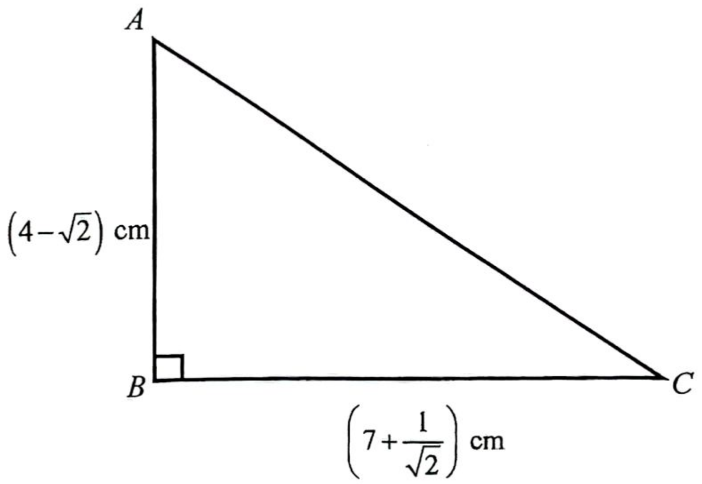
(b) Express $\dfrac{5+\sqrt{3}}{3-\sqrt{3}} - \dfrac{\sqrt{300}}{3} + \sqrt{192}$ in the form $a+b\sqrt{3}$, where a and b are integers. [4]

2 **(a)** By using an appropriate substitution or otherwise, solve $7^{4x+2} - 3(49^{2x}) = 322$. [3]

(b) Simplify $\dfrac{\sqrt[n]{a^{n+4}}}{\sqrt[n]{a^4}}$, where $a > 0$ and n is a positive integer. [2]

3 In the triangle ABC, $AB = (4-\sqrt{2})$ cm, $BC = (7+\dfrac{1}{\sqrt{2}})$ cm, and angle $ABC = 90°$.

Find an expression for $(AC)^2$ in the form $(a+b\sqrt{2})$ cm^2, where a and b are rational numbers. [3]



4 The equation of a curve is $y = -2x^2 + 13x - 11$.

(a) Express $-2x^2 + 13x - 11$ in the form $a(x-h)^2 + k$, where a, h and k are constants. Hence, find the coordinates of the turning point on the curve. [3]

(b) Sketch the graph of $y = -2x^2 + 13x - 11$, indicating clearly the turning point, the y-intercept and x-intercepts of the curve. [3]

5 **(a)** The line $y = 10x + 1$ intersects the curve $y = 2x^2 - 12x - 23$ at two points.

Find the y-coordinates of these two points. [3]

(b) Find value of the constant k for which the line $y = 3k - 2x$ just touches the curve $y = 2x^2 - 12x - 23$. [3]

6 Find the range of values of x for which $(3 - x)^2 > 4x$. [3]

End of Paper

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1a $\sqrt{3x+22} = x+4$

$3x+22 = x^2+16+8x$

$x^2+16+8x-3x-22=0$

$x^2+5x-6=0$

$(x-1)(x+6)=0$

$\therefore x-1=0$ or $x+6=0$

$x=1$ $\quad x=-6$ (rej.)

Check, $x=-6$ is rejected because $2 \neq -2$

value of $x=1$

3

6

1b $\frac{5+\sqrt{3}}{5-\sqrt{3}} - \frac{\sqrt{300}}{3} + \sqrt{192}$ $= \frac{(5+\sqrt{3})(5+\sqrt{3})}{(5-\sqrt{3})(5+\sqrt{3})} - \frac{10\sqrt{3}}{3} + 8\sqrt{3}$

3

$= \frac{(5+\sqrt{3})^2}{5^2-(\sqrt{3})^2} - \frac{10\sqrt{3}}{3} + 8\sqrt{3}$

Be careful

$\frac{25+3+10\sqrt{3}}{22} - \frac{10}{3}\sqrt{3} + 8\sqrt{3}$

3

$= \frac{28+10\sqrt{3}}{22} - \frac{10}{3}\sqrt{3} + 8\sqrt{3}$

$= \frac{28}{22} + \frac{10}{22}\sqrt{3} - \frac{10}{3}\sqrt{3} + 8\sqrt{3}$

$= 1\frac{3}{11} + 5\frac{4}{33}\sqrt{3}$

2a $7^{4x+2} - 3(49^{2x}) = 322$

$7^{4x+2} - 3(7^{4x}) = 322$

Let $7^{4x} = t$, $t>0$

$49t - 3t = 322$

$46t = 322$

$t = 7$

$\therefore 7^{4x} = 7^1$ 3

$\therefore 4x = 1$ (2b) ?

$x = \frac{1}{4}$

Value of $x = \frac{1}{4}$

3 $AC^2 = AB^2 + BC^2$ (Pythagoras' Theorem)

$AC^2 = (4-\sqrt{2})^2 + (7+\frac{1}{\sqrt{2}})^2$

$AC^2 = 16+2-8\sqrt{2} + (7+\frac{\sqrt{2}}{2})^2$

$AC^2 = 18 - 8\sqrt{2} + 49 + \frac{2}{4} + 7\sqrt{2}$

$AC^2 = 67\frac{1}{2} - \sqrt{2}\ cm^2$

3

4a $-2x^2+13x-11$

$= -2(x^2 - \frac{13}{2} + \frac{11}{2})$

$= -2[(x-\frac{13}{4})^2 - \frac{13^2}{4^2} + \frac{11}{2}]$

$= -2[(x-\frac{13}{4})^2 - \frac{81}{16}]$

$= -2(x-3\frac{1}{4})^2 + 10\frac{1}{8}$ 3

coordinates of turning point $= (3\frac{1}{4}, 10\frac{1}{8})$

4b $y = -2x^2+13x-11$

When $y = 0$,

$-2x^2+13x-11 = 0$

$(2x-11)(x-1) = 0$

$\therefore 2x-11 = 0$ or $x-1=0$

$2x = 11$ $x = 1$

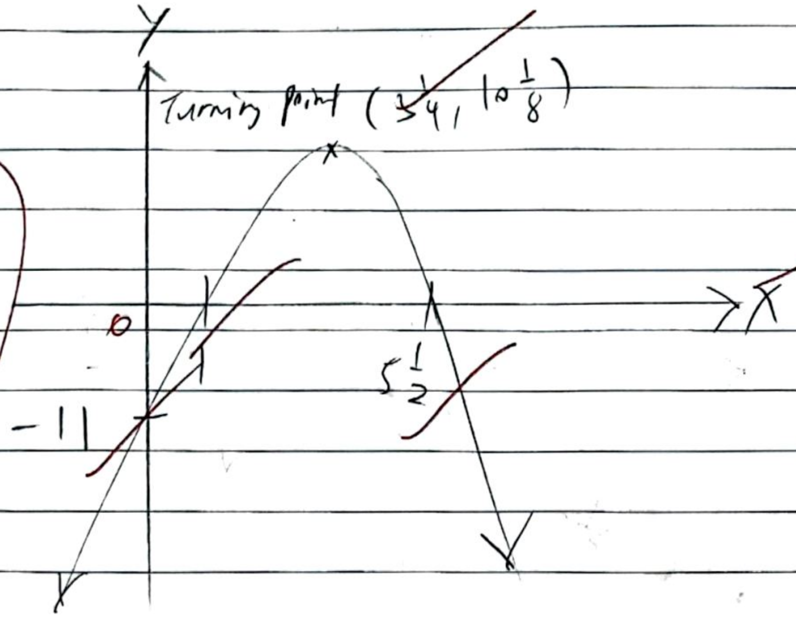
$x = \frac{11}{2}$

$x = 5\frac{1}{2}$

When $x = 0$,

$y = -2(0)^2 + 13(0) - 11$

$y = -11$



5a $y = 10x + 1 \quad -(1)$

$y = 2x^2 - 12x - 23 \quad -(2)$

$\therefore 10x + 1 = 2x^2 - 12x - 23$

$2x^2 - 12x - 23 - 10x - 1 = 0$

$2x^2 - 22x - 24 = 0$ ← simplify

$2(x - 12)(x + 1) = 0$

$\therefore x - 12 = 0$ or $x + 1 = 0$

$x_1 = 12 \qquad x_2 = -1$

Substitute $x_1 = 12$ into (1): $y = 10(12) + 1$

$y = 121$

Substitute $x_2 = -1$ into (1): $y = 10(-1) + 1$

$y = -9$

$\therefore$ intersection of the line $y = 10x + 1$ and curve $y = 2x^2 - 12x - 23$ are $(12, 121)$ and $(-1, -9)$

The y-coordinates are 121 and -9

5b $y = 3k - 2x$

$y = 2x^2 - 12x - 23$

$\therefore 3k - 2x = 2x^2 - 12x - 23$ 2

5

$2x^2 - 12x - 23 - 3k + 2x = 0$

$2x^2 - 10x + (-23 - 3k) = 0$

Discriminant, $b^2 - 4ac$, $(-10)^2 - 4(2)(-23 - 3k) = 0$

$100 + 184 + 24k = 0$

$24k = -284$

$k = -11\frac{5}{6}$

$\therefore$ value of $k = -11\frac{5}{6}$

6 $(3 - x)^2 > 4x$

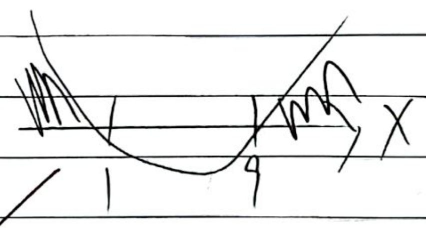
$9 + x^2 - 6x - 4x > 0$

3

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

$(x - 9)(x - 1) > 0$

$\therefore x < 1$ or $x > 9$



2b $\dfrac{\sqrt[n]{a^{n+4}}}{\sqrt[n]{a^4}}$

$= \dfrac{a^{1+\frac{4}{n}}}{a^{\frac{4}{n}}}$

5

$\dfrac{a \cdot a^{\frac{4}{n}}}{a^{\frac{4}{n}}}$ 2

$= a$