

1. Given $s = 5r\sqrt{s^2 + q}$, express s in terms of q and r . $s = 5r\sqrt{q/(1-25r^2)}$ [3]

2. (a) Express $\frac{2}{x+3} - \frac{5y}{3x^2-27} - \frac{2}{3-x}$ as a single fraction. $(12x-5y)/3(x+3)(x-3)$ [3]

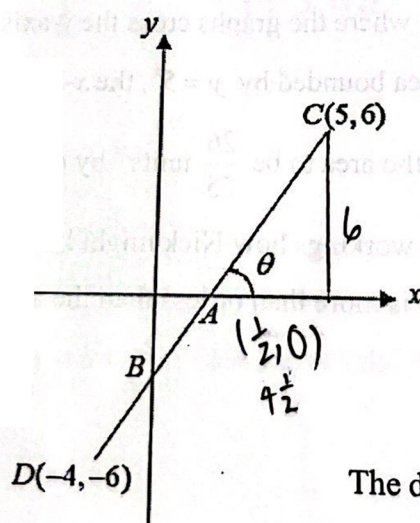
- (b) Hence, find the value of $\frac{y}{x}$ when $\frac{2}{x+3} - \frac{5y}{3x^2-27} - \frac{2}{3-x} = 0$. $12/5$ [2]

3. The side of a cube is x cm long. The side of another cube is 2 cm shorter. The difference of the volumes of these two cubes is 98 cm^3 .

- (a) Factorise the expression $x^3 - (x-2)^3$ completely. $2(3x^2-6x+4)$ [2]

- (b) Hence, form an equation and show that reduces to $x^2 - 2x - 15 = 0$, and find the side of the smaller cube. 3 cm [3]

4. The diagram shows line CD intersects the axes at A and B respectively.

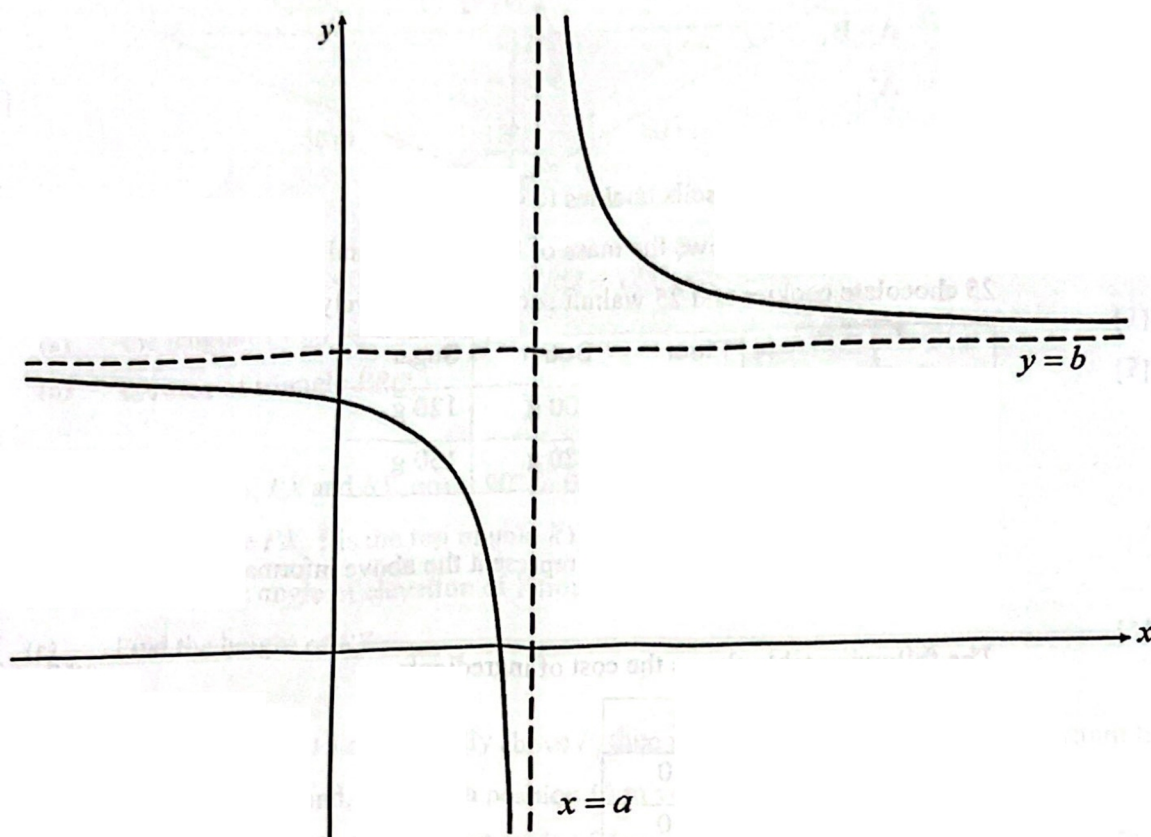


The diagram is not drawn to scale.

- (a) Given the points $C(5, 6)$ and $D(-4, -6)$, find the equation of the line CD . $y = 4/3x - 2/3$ [3]
- (b) Find the coordinates of the points A and B . $A(1/2, 0)$, $B(0, -2/3)$ [3]
- (c) The line CD makes an acute angle θ degrees with the x -axis. Find the value of θ . 53.1 deg [2]

5. The line $x + y = 10$ meets the curve $y^2 = 2x + 4$ at points A and B . Find the distance AB . [6]
 $11\sqrt{2}$
6. Describe the two successive transformations that the graph of $y = x^3$ undergoes to obtain the graph of $y = \frac{4}{3}(x-5)^3$.
 Step 1: translate 5 units in the positive x direction
 Step 2: scale parallel to the y -axis by a scale factor $\frac{4}{3}$ [2]
7. (a) Given the points $A(-2, 3)$ and $B(4, -5)$, find the equation of the perpendicular bisector of AB .
 $y = \frac{3}{4}x - \frac{7}{4}$ [4]
- (b) The line $y = \frac{1}{3}x + \frac{13}{4}$ intersects the perpendicular bisector of AB at C .
 (i) Find the coordinates of C . $C(12, 29/4)$ [3]
 (ii) Calculate the area of the triangle ABC . 68.75 [2]
8. (a) On the same axes, sketch the graphs of $y = 5^x$ and $y = 0.2^x$.
 Indicate clearly the point where the graphs cross the y -axis. [3]
- (b) Nick wants to find the area bounded by $y = 5^x$, the x -axis and the lines $x = -2$ and $x = 0$. He estimates the area to be $\frac{26}{25}$ units² by drawing a trapezium.
 Show with mathematical workings how Nick might have arrived at his estimate.
 Determine if his estimate is more than or less than the actual area. [2]
 It is more than the actual area

9. The diagram shows a sketch of the graph of $y = \frac{3x-5}{x-2}$. The asymptotes are $x = a$, and $y = b$.



The diagram is not drawn to scale.

Express $y = \frac{3x-5}{x-2}$ as $y = b + \frac{1}{x-2}$. Hence, or otherwise, find the value of a and of b . [3]

$$a=2, b=3$$

[Turn over

10. (a) Given $A = \begin{pmatrix} 2 & c \\ d & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \\ 3+2d & -1 \end{pmatrix}$, find in terms of c and d ,

(i) $A - B$, $((1, c), (-d-3, 1))$ [1]

(ii) A^2 , $((cd+4, 2c), (2d, cd))$ [2]

(b) ExpressJay makes and sells cookies to cafes.

The following table shows the mass of flour, butter, and sugar ExpressJay uses in making 25 chocolate cookies and 25 walnut cookies respectively.

	Flour	Butter	Sugar
Chocolate cookies	200 g	200 g	120 g
Walnut cookies	220 g	180 g	150 g

(i) Write a 2×3 matrix, M to represent the above information. [1]

$$M = ((200, 200, 120), (220, 180, 150))$$

The following table shows the cost of ingredients.

	Cost
100 g of flour	\$1.20
100 g of butter	\$2.80
100 g of sugar	\$0.70

(ii) Given $T = MC$, where $C = \begin{pmatrix} 0.012 \\ 0.028 \\ 0.007 \end{pmatrix}$, evaluate T . $T = (8.84, 8.73)$ [2]

(iii) State what each of the elements of T represent. [1]

It represents the total costs needed for baking 24 chocolate cakes and 25 cookies respectively

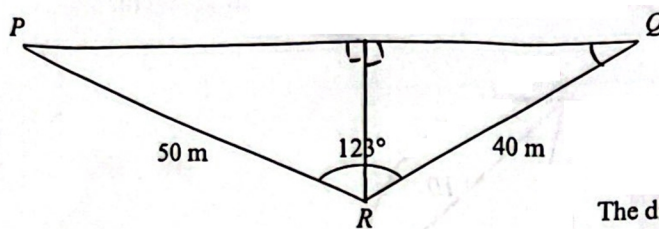
ExpressJay decides that the selling price of 25 chocolate cookies is 450% of the total cost of the three main ingredients, and the selling price of 25 walnut cookies is 500% of the total cost of the three main ingredients.

The elements of matrix P , where $P = ST$, represent the respective selling prices of 25 chocolate cookies, and of 25 walnut cookies.

(iv) Write down the square matrix S . $S = ((4.5, 0), (0, 5))$ [1]

(v) Hence, evaluate P . $P = (39.78, 43.65)$ [1]

11. The diagram shows three locations, P , Q , and R on level ground at Sembawang Campsite.



The diagram is not drawn to scale.

Given $PR = 50$ m, $QR = 40$ m, and angle $PRQ = 123^\circ$, calculate

- (a) the length of PQ , 79.2 [2]
 (b) the area of triangle PRQ . 839 [2]

Two vertical poles, PX and RY , are at 90° to the ground at P and R respectively.

X is the top of pole PX . Y is the top of pole RY .

PX is 6 m tall. The angle of elevation of Y from X is 2.6°

- (c) Find the height of RY . 8.27 [3]

A camera drone hovers 15 m vertically above P , then moves in a straight path at a constant height of 15 m above level ground, towards a position 15 m vertically above Q .

- (d) Along this path, find the largest angle of depression from the drone to Y . [3]

17.6 deg

12. Circle P has the equation $x^2 + y^2 - 10x + 4y + 13 = 0$.

Circle Q has the equation $(x-2)^2 + (y-2)^2 = 9$.

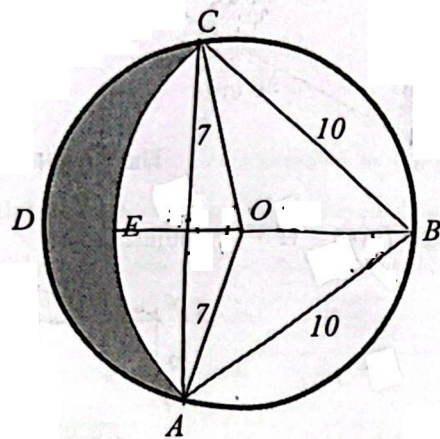
- (a) Find the centre, and the radius, of circle P . center(5,-2), radius=4 [3]

- (b) X is a point on circle P , and Y is a point on circle Q .

Find the largest possible distance of XY . 12 [2]

[Turn over

13. In the diagram, A, B, C and D are points on the circumference of a circle with centre O and radius 7 cm. AEC is an arc on a circle with centre B and radius 10 cm.



The diagram is not drawn to scale.

- (a) Show that $\angle OBA = 0.775$ radians (correct to 3 significant figures) [2]
Hence, calculate
- (b) the length of arc ADC , 21.7 [3]
(c) the area of segment ADC , 76.0 [2]
(d) the area of the shaded region. 47.5 [3]

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