



## FORMULAE LIST

### Circle

$x^2 + y^2 + 2gx + 2fy + c = 0$  represents a circle centre  $(-g, -f)$ , radius  $\sqrt{g^2 + f^2 - c}$ .

$(x - a)^2 + (y - b)^2 = r^2$  represents a circle centre  $(a, b)$  and radius  $r$ .

### Scalar product

$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}||\mathbf{b}| \cos \theta$ , where  $\theta$  is the angle between  $\mathbf{a}$  and  $\mathbf{b}$

or

$$\mathbf{a} \cdot \mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3 \text{ where } \mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$$

### Trigonometric formulae

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

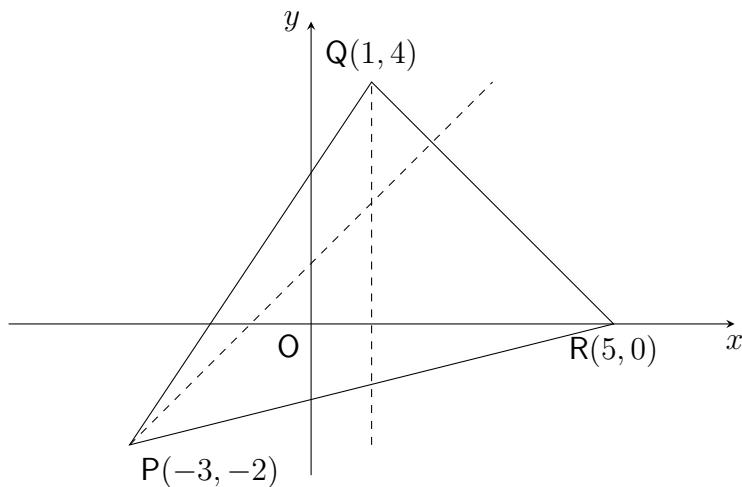
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1. Find  $\int (8x^5 - 12x^2) dx$  (2)

2. Vectors  $\mathbf{u} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$  and  $\mathbf{v} = k\mathbf{i} + 6\mathbf{k}$  are perpendicular. Find the value of  $k$ . (2)

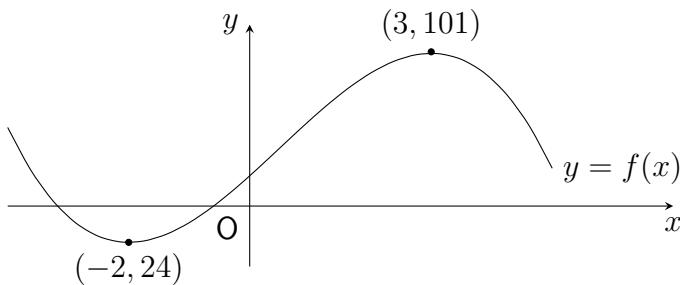
3. A curve has equation  $y = 2x^3 - 4x^2 + 7x - 2$ .  
Find the equation of the tangent to this curve at the point where  $x = 1$ . (4)

4. Triangle PQR has vertices  $P(-3, -2)$ ,  $Q(1, 4)$  and  $R(5, 0)$ .



- (a) Find the equation of the altitude through  $P$ . (3)
- (b) Find the equation of the median through  $Q$ . (3)
- (c) Find the coordinates of the point of intersection of the altitude through  $P$  and the median through  $Q$ . (2)

5. Part of the graph of  $y = f(x)$  is shown below, where  $f(x)$  is a cubic function. (3)

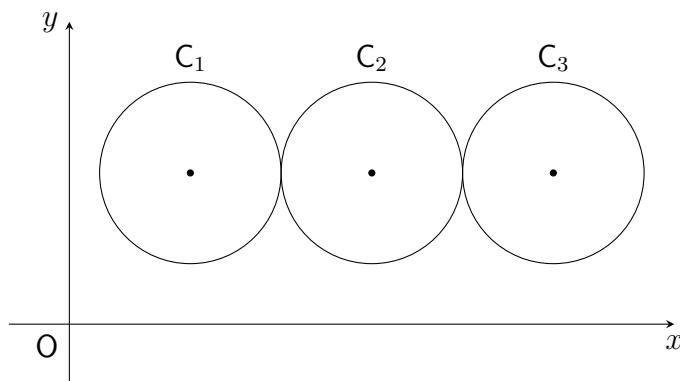


Sketch the graph of  $y = f'(x)$ .

6. Given that  $\cos p = \frac{\sqrt{7}}{4}$ , where  $0 < p < \frac{\pi}{2}$ , find the exact value of:

- (a)  $\sin p$  (1)
- (b)  $\sin 2p$  (2)

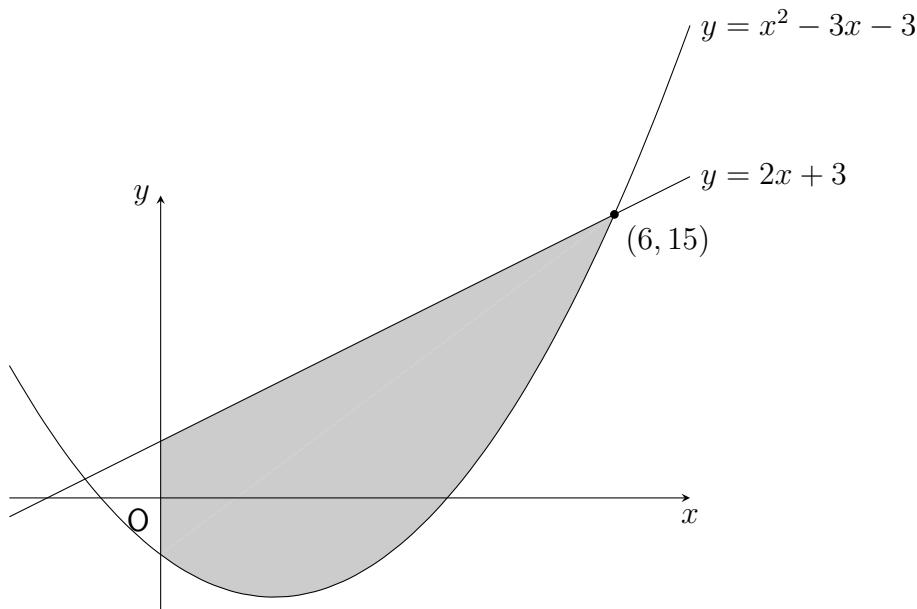
7. Three congruent circles are aligned horizontally and touch as shown below.



Circle  $C_1$  has equation  $x^2 + y^2 - 8x - 10y + 32 = 0$ .

- (a) Find the centre and radius of circle  $C_1$  (2)
- (b) Determine the equation of circle  $C_2$ . (3)
- (c) Find the coordinates of the point at which circles  $C_2$  and  $C_3$  touch. (2)

8. The diagram shows the line with equation  $y = 2x + 3$  intersecting with the parabola with equation  $y = x^2 - 3x - 3$  at the point  $(6, 15)$ . (5)



Calculate the shaded area.

9. Solve the equation  $2 \sin 2x^\circ + 3 \cos x^\circ = 0$ , where  $0 < x < 360$ . (4)

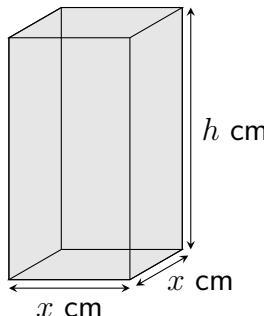
10. The coordinates of points A, B and C are given by A(-4, 1, 5), B(3, 2, 0) and C(1, -5, 6).

(a) Express  $\overrightarrow{CA}$  and  $\overrightarrow{CB}$  in component form. (2)

(b) Hence calculate the size of angle ACB. (5)

11. Determine the range of values of  $x$  for which  $y = x^3 - 6x^2 - 15x - 4$  is increasing. (4)

12. A solid cuboid measures  $x$  cm by  $x$  cm by  $h$  cm. Its volume is 125 cm<sup>3</sup>. (8)



(a) Show that the surface area of the cuboid can be given by:

$$A(x) = 2x^2 + \frac{500}{x}$$

(b) Find the value of  $x$  such that the surface area is minimised.

13. Given  $\mathbf{u} = \begin{pmatrix} 2 \cos x \\ 3 \\ -1 \end{pmatrix}$  and  $\mathbf{v} = \begin{pmatrix} \sin x \\ 0 \\ \frac{1}{2} \end{pmatrix}$  are perpendicular, and  $\frac{\pi}{4} < x < \frac{\pi}{2}$ , find  $x$ . (6)

| Question     | Topic              | Marks Available | Marks Awarded |
|--------------|--------------------|-----------------|---------------|
| 1            | Integration        | 2               |               |
| 2            | Vectors            | 2               |               |
| 3            | Differentiation    | 4               |               |
| 4            | Straight Lines     | 8               |               |
| 5            | Differentiation    | 3               |               |
| 6            | Addition Formulae  | 3               |               |
| 7            | The Circle         | 7               |               |
| 8            | Integration        | 5               |               |
| 9            | Addition Formulae  | 4               |               |
| 10           | Vectors            | 7               |               |
| 11           | Differentiation II | 4               |               |
| 12           | Differentiation II | 8               |               |
| 12           | Addition Formulae  | 6               |               |
| <b>Total</b> |                    | 65              |               |

# ANSWERS - Practice Exam A Paper 2

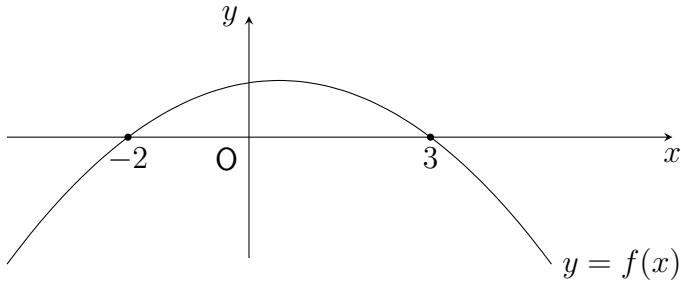
1.  $\frac{4x^6}{3} - 4x^3 + C$

2.  $k = -4$

3.  $y = 5x - 2$

4. (a)  $y = x + 4$   
(b)  $x = 1$   
(c)  $(1, 2)$

5.



6. (a)  $\sin p = \frac{3}{4}$

(b)  $\sin 2p = \frac{3\sqrt{7}}{8}$

7. (a) Centre  $(4, 5)$ , radius= 3  
(b)  $(x - 10)^2 + (y - 5)^2 = 9$   
(c)  $(13, 5)$

8. Area= 54 square units

9.  $x = 90, 228.6, 246.8, 270, 293.2, 311.4$

10. (a)  $\overrightarrow{CA} = \begin{pmatrix} -5 \\ 6 \\ -1 \end{pmatrix}$  and  $\overrightarrow{CB} = \begin{pmatrix} 2 \\ 7 \\ -6 \end{pmatrix}$

(b)  $59.2^\circ$

11.  $x < -1, x > 5$

12.  $x = 5$

13.  $x = \frac{5\pi}{12}$