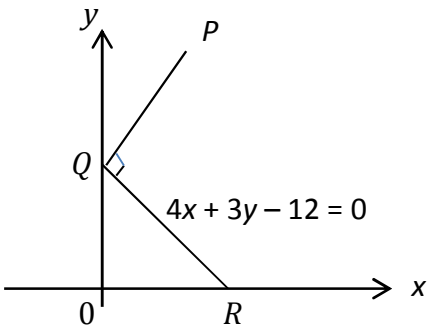
1 Find the equation of the normal to the curve $y = x + 1 + \frac{4}{x^2}$ at the point (1,6). [4]

2 The diagram shows two straight lines *PQ* and *QR* perpendicular to each other. Points *Q* and *R* lie on the *y*-axis and *x*-axis respectively. Given that the equation of the line QR is $4x + 3y - 12 = 0$.



If *PQ* is extrapolated to intersect the x-axis at point *M* such that *PQ* = *QM*, find the coordinates of point *P*. [5]

3 **(i)** Find the first four terms of the binomial expansion of $(3-2x)^5$ in ascending powers of *x*. [3]

(ii) Hence find the coefficient of x^3 in the expansion of $\left(1+\frac{1}{2}x\right)^2(3-2x)^5$. [3]

4 Daniel bought an apartment at RM*x*. The value of the apartment appreciates 7% annually. It is given that the value of the apartment after 2 years is RM110, 000. Find

(i) the value of *x*, [2]

(ii) the estimated value of the apartment 8 years after his purchase, [2]

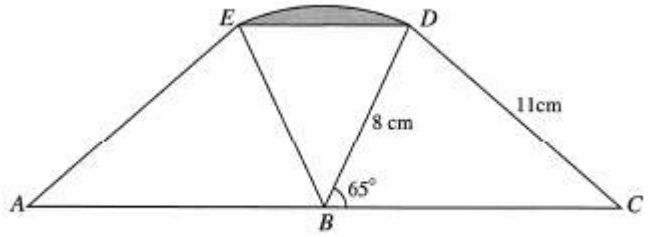
(iii) the minimum number of years for the value of the apartment to be double. [3]

5 By cutting away x cm from each corner of a rectangular piece of cardboard and folding up the resulting flaps, we can turn the cardboard into an open box. If the cardboard is 16 cm long and 10 cm wide.

(i) Show that the volume, V cm^3, of the box is given by $V = 160x - 52x^2 + 4x^3$. [2]

(ii) Find the dimensions of the box that will yield the maximum volume. [5]

6



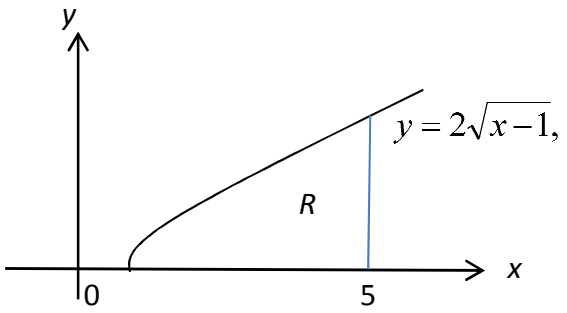
The diagram shows two congruent triangles ABE and CBD, where ABC is a straight line. In triangle BCD, BD is 8 cm, CD is 11 cm and angle CBD is 65^0. The points E and D are joined by an arc of a circle with centre B and radius 8 cm.

(i) Find angle BCD. [2]

(ii) Show that angle EBD is 0.873 radians, correct to 3 significant figures. [2]

(iii) Hence find the area of the shaded segment, bounded by the chord ED and the arc ED, giving your answer correct to 3 significant figures. [3]

7 The diagram shows the curve with equation $y = 2\sqrt{x-1}$, the line $x = 5$, and the x-axis.



(i) Find the exact area of the region R. [3]

(ii) Find the exact volume of the solid formed when the region R is rotated through 360^0 about the y-axis. [6]

8 **(a)** Sketch the graph $y = 3 - sin2x$ for $0 \leq x \leq 180°$. [3]

(b) **(i)** Show that $\frac{\sin^2 x - \cos^2 x}{1 - \sin^2 x} \equiv \tan^2 x - 1$. [2]

(ii) Hence solve the equation $\frac{\sin^2 x - \cos^2 x}{1 - \sin^2 x} = 5 - \tan x$ for $-\pi \leq x \leq \pi$. [5]

9 The functions f and g are defined with their respective domains by

$$\mathrm{f}(x) = 2 - x^4 \text{ for all real values of } x$$

$$\mathrm{g}(x) = \frac{1}{x - 4}$$

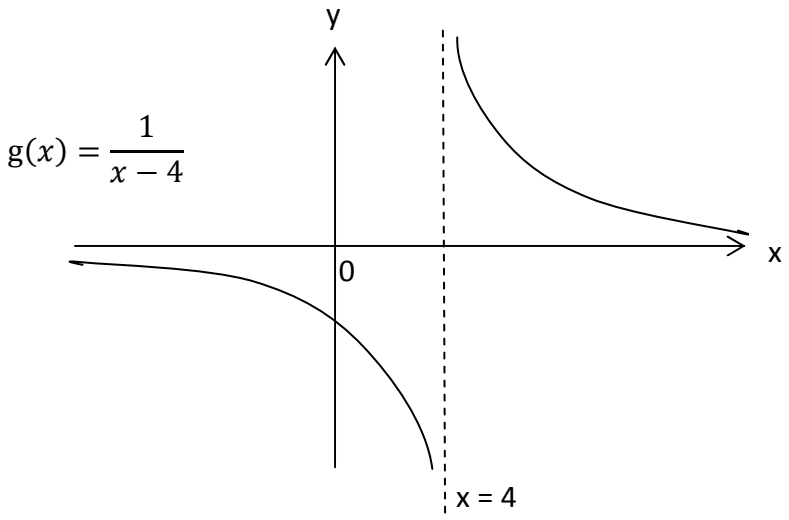
for all real values of x, $x \neq 4$

(i) State the range of f. [1]

(ii) Explain why f does not have an inverse. [1]

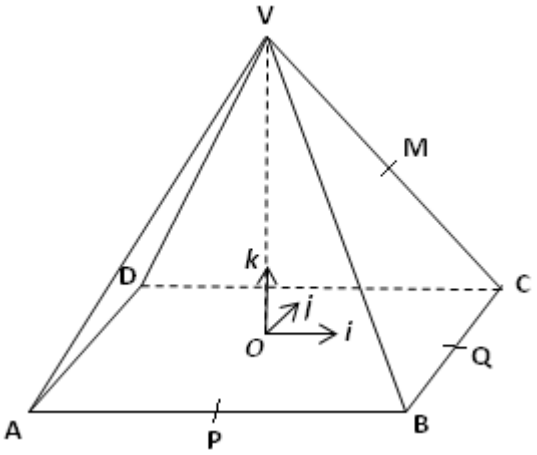
(iii) Solve the equation $\mathrm{fg}(x) = -14$. [3]

Below is the graph of $y = \mathrm{g}(x)$.



(iv) Find the inverse of $\mathrm{g}(x)$. State the domain and range of g^{-1}. [5]

10



In the diagram, O is the centre of the square base $ABCD$ of a right pyramid, vertex V. Unit vectors **i**, **j**, **k** are parallel to AB, AD and OV respectively. The length of AB is 4 units, and the length of OV is $2h$ units. M, P and Q are the mid-point of VC, AB, and BC respectively. The point O is taken as the origin for the position vectors.

(i) Express the vectors $\overrightarrow{MV}$ *and* $\overrightarrow{MP}$ in terms of h. [3]

(ii) Given that $\overrightarrow{OX} = \frac{1}{2}\boldsymbol{i} - \frac{1}{2}\boldsymbol{j} + h\boldsymbol{k}$, and is perpendicular to $\overrightarrow{VB}$, find the value of h. [3]

(iii) Use the value of h in part (ii) to calculate the angle VMP. [4]