## Section A: The basics

**1 (a)** Circle the equivalent expression to $\left(\sqrt[3]{x}\right)^4$

$x^{\frac{3}{4}}$ $\frac{4}{\sqrt[3]{x}}$ $x^{\frac{4}{3}}$ $x^{4\frac{1}{3}}$

**[1 mark]**

**1 (b)** Write down the value of $p$ and $q$ given that:

**(i)** $9^p = 1$

**(ii)** $\frac{1}{81} = 3^q$

**[2 marks]**

**2 (a)** Simplify the expression $\left(5+\sqrt{2}\right)\left(5-2\sqrt{2}\right)$

**[2 marks]**

**2 (b)** Simplify $\frac{4}{\sqrt{5}-3}$ by rationalising the denominator

**[3 marks]**

**3 (a)** Factorise the expression $x^2-2$

**[1 mark]**

**3 (b)** Factorise the expression $6x^2-5x-21$

**[2 marks]**

**4 (a)** Sketch the curve $y = x^2 - x - 4$ , indicating the exact intercepts on the $x$-axis and the $y$-axis.

**[4 marks]**

**4 (b)** Complete the square on the curve $y = x^2 - x - 4$

**[2 marks]**

**4 (c)** State the minimum point and any lines of symmetry

**[2 marks]**

## Section B: A bit more thinking

**5** A parallelogram has base $\left(3+5\sqrt{2}\right)$ cm and area $\left(10+3\sqrt{2}\right)$ cm$^2$.

Find the perpendicular height in its simplest form

**[4 marks]**

**6** Solve the quadratic equation $\frac{5}{(x+3)}+\frac{1}{(x-1)}=2$

**[4 marks]**

**7** Solve $x^{\frac{2}{3}}-17x^{\frac{1}{3}}+16=0$

**[5 marks]**

## Section A: The basics

**1** Calculate the discriminant of the quadratic $y = 3x^2 - 5x + 4$.

Use this to determine how many solutions the equation has.

**[3 marks]**

**2** Solve the inequality $3x + 4 < 5x - 2$

**[2 marks]**

**3** Find the points of intersection between the graph $y = x^2 + 5x - 3$ and the line $y = 2x + 1$.

**[3 marks]**

**4** Expand $(2x + 3)(x^2 - 3x + 6)$

**[2 marks]**

**5** **(a)** Using the Factor Theorem, show that $x - 2$ is a factor of

$p(x) = x^3 + 4x^2 - 19x + 14$

**[2 marks]**

**(b)** Hence, find the quotient and express $x^3 + 4x^2 - 19x + 14$ as a product of 3 linear factors.

**[3 marks]**

## Section B: A bit more thinking

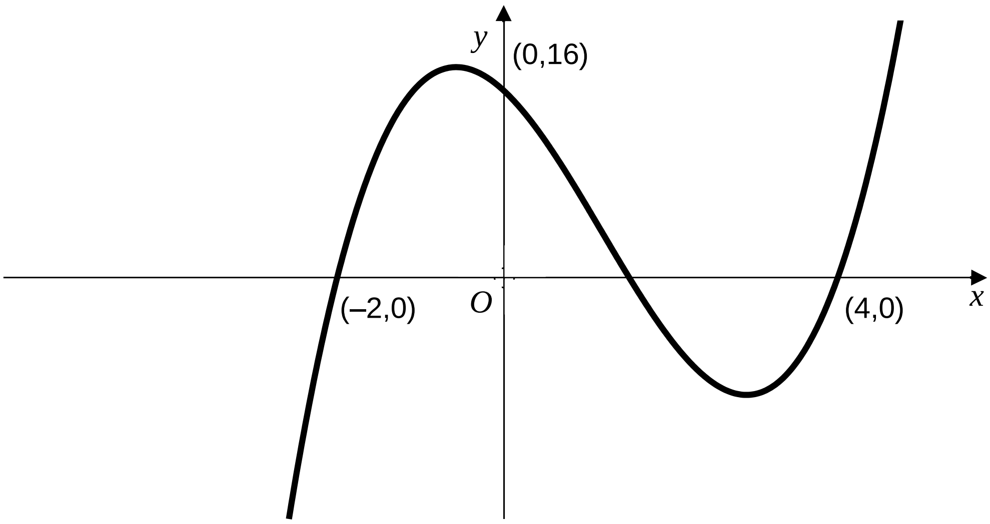
**6** Given that $x + 2$ and $x - 3$ are factors of the polynomial $p(x) = 3x^3 + bx^2 - cx + 5$, find the value of $b$ and $c$.

**[4 marks]**

**7** Prove that the line $y = x - 5$ does not intersect with the quadratic $y = x^2 + 6x + 13$

**[4 marks]**

**8** Use the sketch below to identify the cubic equation in the form $y = x^3 + ax^2 + bx + c$, where $a$, $b$ and $c$ are integers.




**[4 marks]**

**9** Given that the cubic has a factor of $x - 2$, solve the inequality $x^3 + 2x^2 - 13x + 10 > 0$

**[5 marks]**

## Section A: The basics

**1** Which of the following options represents the transformation that maps the graph of onto the graph of $y = \frac{1}{4}|x+2|$?

Circle your answer.

| | | | |
|---|---|---|---|
| A stretch, parallel to the $x$-axis, scale factor $\frac{1}{4}$ | A stretch, parallel to the $x$-axis, scale factor 4 | A stretch, parallel to the $y$-axis, scale factor $\frac{1}{4}$ | A stretch, parallel to the $y$-axis, scale factor 4 |

**[1 marks]**

**2** Sketch the graph of the curve with equation $y = (2x+1)(x-3)^2$

**[2 marks]**

**3 (a)** The curve with equation $y = \frac{5}{x^2}$ is translated by vector $\begin{bmatrix} 0 \\ 2 \end{bmatrix}$.

Write down the equation of the transformed curve.

**[1 mark]**

**3 (b)** Sketch the transformed curve, labelling the equations of its asymptotes

**[2 marks]**

**4 (a)** Sketch, on the same set of axes, the graphs of the curves $y = \frac{1}{x+1}$ and $y = (2x+5)(x+1)(x-3)$.

Label the points where the curves cross the axes, where the curves intersect and any asymptotes.

**[4 marks]**

**4 (b)** Hence state the number of real solutions to the equation

$$\frac{1}{x+1} = (2x+5)(x+1)(x-3)$$

**[1 mark]**

**5 (a)** The average velocity, $V$ metres per second, at which a runner completes a race is inversely proportional to the total time, $T$ seconds, it takes for them to complete the race.

Sketch a graph of $V$ against $T$ for positive values of $T$

**[2 marks]**

**5 (b)** Alex completes the race in 70 seconds and his average velocity is 6 metres per second.

Find the time it takes Dexter to complete the race, given that his average speed is 5.6 metres per second.

**[2 marks]**

**Section B: A bit more thinking**

**6** The curve with equation $y = \frac{3}{x^2}$ is stretched by scale factor 4 parallel to the $x$-axis.

This transformed curve could also be obtained by stretching $y = \frac{3}{x^2}$ by scale factor $k$ parallel to the $y$-axis.

State the value of $k$.

**[2 marks]**

**7** State the transformation that maps the graph of $y = 4x^2 + 3$ onto the graph of $y = x^2 + 3$

**[2 marks]**

**8 (a)** $\mathrm{f}(x) = 54a\sqrt{a}\,x^3 + 27ax^2 - 51\sqrt{a}x + 12$, where $a$ is a non-zero constant.

Show that a stretch scale factor $3\sqrt{a}$ parallel to the $x$-axis transforms the curve $y = \mathrm{f}(x)$ onto the curve $y = \mathrm{g}(x)$, where $\mathrm{g}(x) = 2x^3 + 3x^2 - 17x + 12$

**[3 marks]**

**8 (b)** Hence find the solutions to $\mathrm{f}(x) = 0$, giving your answers in terms of $a$.

**[3 marks]**

**9 (a)** The line $y = kx$, where $k$ is a non-zero constant, touches the curve $y = \frac{1}{x-3}$ at exactly one point.

Find the value of $k$.

**[3 marks]**

**9 (b)** Using the value of $k$ found in part **(a)**, sketch the curves $y = \frac{1}{x-3}$ and $y = kx$ on the same set of axes.

You should label the point of intersection between the two curves.

**[3 marks]**

**9 (c)** Explain why it is necessary to have the condition that $k$ is a non-zero constant.

**[1 mark]**

## Section A: The basics

**1** Write down the equation of the line with gradient 3 through the point (4, –1) in the form $y - y_1 = m(x - x_1)$.

**[1 mark]**

**2 (a)** Find the gradient and the $x$- and $y$-intercepts of the line with equation $2x + 3y - 7 = 0$.

**[3 marks]**

**2 (b)** Find the equation of a line that is parallel to $2x + 3y - 7 = 0$ through the point (3, 5).

**[3 marks]**

**2 (c)** When does the line $y = 2x + 1$ intersect the line $2x + 3y - 7 = 0$?

**[2 marks]**

**3 (a)** The point *P* has coordinates (–2, 2), the point *Q* has coordinates (1, 6) and the point *R* has coordinates (5, 3).

Show that *PQ* and *QR* are perpendicular.

**[3 marks]**

**3 (b)** Find the distance of *RQ* .

**[2 marks]**

**4** Find the equation of a circle with centre (2, –5) and diameter 16.

**[2 marks]**

**5** Find the centre and radius of the circle with equation $x^2 + y^2 + 4x - 6y - 8 = 0$ .

**[3 marks]**

## Section B: A bit more thinking

**6** A circle passes through points *A* (7, 4), *B* (10, 6) and *C* (12, 3). Show that *AC* must be the diameter of the circle.

**[4 marks]**

**7** The points *A* (1, 4) and *B* (5, 1) lie on a circle. The line segment *AB* is a chord. Find the equation of a diameter of the circle.

**[5 marks]**

**8** A line has equation $y = k$, where $k$ is a constant. For which values of $k$ does the line not intersect the circle with equation $x^2 + 3x + y^2 + 2y - \frac{3}{4} = 0$.

**[4 marks]**

**Section A: The basics**

**1 (a)** Express the first four terms of the expansion $(2 - 3x)^8$ in ascending powers of $x$.

**[4 marks]**

**2** Find the coefficient of $x^5$ in the expansion $\left(2+\frac{1}{2}x\right)^{11}$

**[3 marks]**

**3 (a)** By first completing the square, find the minimum point for the quadratic $y = x^2 + 7x - 30$.

**[3 marks]**

**3 (b)** Hence, sketch the graph $y = x^2 + 7x - 30$, including labelling where it crosses the axes.

**[4 marks]**

**Section B: A bit more thinking**

**4 (a)** Using the Factor Theorem, show that $x + 3$ is a factor of $p(x) = x^3 + 9x^2 + 27x + 27$

**[2 marks]**

**4 (b)** Hence, or otherwise express $x^3 + 9x^2 + 27x + 27$ as a product of linear factors.

**[2 marks]**

**4 (c)** Hence, describe the transformation from $y = x^3 + 9x^2 + 27x + 27$ onto $y = (x - 2)^3 + 2$

**[3 marks]**

**5 (a)** Using the binomial expansion, or otherwise, express $(2 + 3x)^3$ in the form $a + bx + cx^2 + x^3$.

**[2 marks]**

**5 (b)** Hence find the coefficient of $x$ in the expansion $(2 + 3x)^3(1 - x^{-1})^5$.

**[4 marks]**

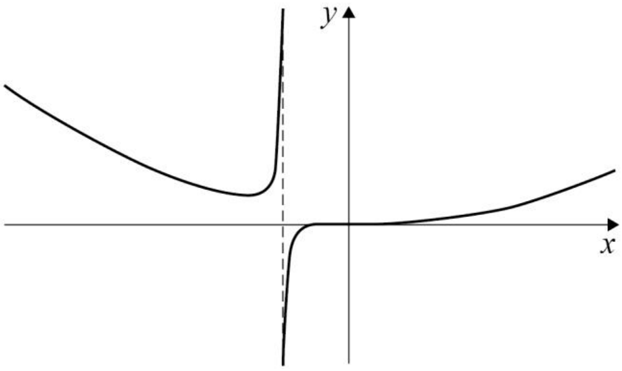
**6** Show with clear steps and a clear conclusion whether the line $y = 3x + 2$ is a tangent to the circle $(y - 1)^2 + (x - 3)^2 = 25$.

**[5 marks]**

Differentiation 1

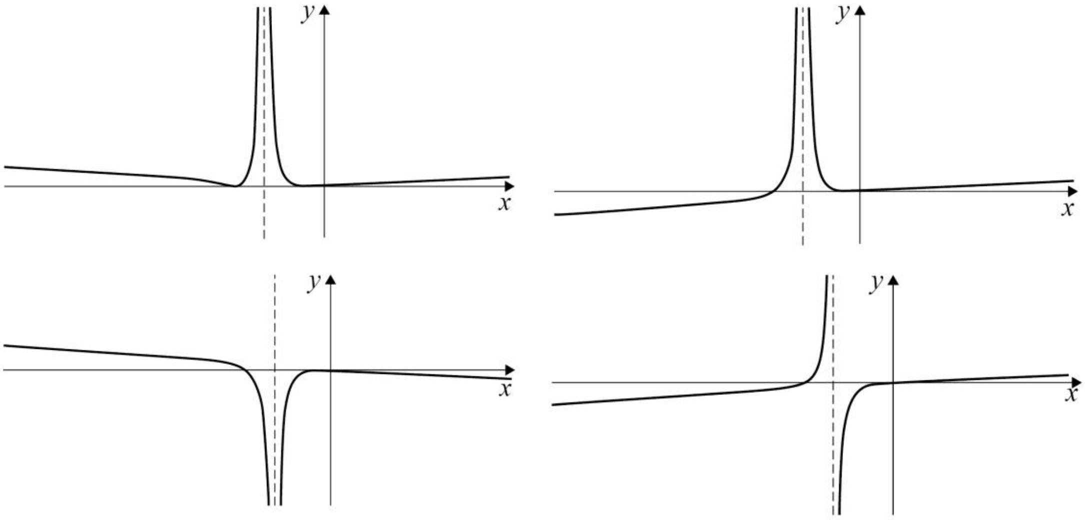
## Section A: The basics

**1** The graph of $y = \mathrm{f}(x)$ is shown in the diagram.




Which of the following graphs is a sketch of its gradient function?

Circle your answer




**[1 mark]**

**2 (a)** Use the binomial expansion to express $(2+h)^3$ in the form $h^3 + 6h^2 + ph + q$ , where $p$ and $q$ are integers to be determined.

**[2 marks]**

**2 (b)** The curve with equation $y = x^3 - 5x$ passes through the point $P(2, -2)$ and the point $Q$, where $x = 2 + h$.

Using differentiation from first principles, find the gradient of the tangent to the curve at the point $P$.

**[3 marks]**

**3 (a)** Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $y = x^4 - 3x^3 + 2x + 14$

**[2 marks]**

**3 (b)** Find $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$

**[1 mark]**

**4** Given $\mathrm{f}(x) = (2x - 3)(4 + 7x - 2x^2)$, find $\mathrm{f}'(x)$.

**[3 marks]**

**5 (a)** Express $x^2\sqrt{x}$ in the form $x^p$, where $p$ is a rational number.

**[1 mark]**

**5 (b)** Hence find $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $y = x^2\sqrt{x} - \frac{3}{x}$.

**[2 marks]**

## Section B: A bit more thinking

**6** Samir, a maths student, is using differentiation from first principles to evaluate the gradient of the curve $y = x^2 + 6x$ at the point where $x = -4$.

His working is as follows:

Step 1 When $x = -4$, $y = 16 - 24 = -8$

Step 2 When $x = -4 + h$, $y = (-4+h)^2 + 6(-4+h)$
$= 16 + h^2 - 24 + 6h$
$= h^2 + 6h - 8$

Step 3 Gradient of chord $= \dfrac{(h^2 + 6h - 8) - (-8)}{(-4+h) - (-4)} = \dfrac{h^2 + 6h}{h} = h + 6$

Step 4 Let $h = 0$. Then $\dfrac{dy}{dx} = 6$

There are two errors in Samir's working. Explain where these two errors occur.

**[2 marks]**

**7 (a)** The height of a mountain, $h$ kilometres, at a horizontal distance of $x$ kilometres from a starting point, can be modelled by the equation $h = 0.75x^{\frac{4}{3}} - 0.3x^2$.

Find $\dfrac{dh}{dx}$ when $x = 1$and interpret this value in context.

**[3 marks]**

**7 (b)** Find $\dfrac{d^2h}{dx^2}$ when $x = 1$ and interpret this value in context.

**[2 marks]**

**7 (c)** State one limitation of using the equation $h = 0.75x^{\frac{4}{3}} - 0.3x^2$ to measure the actual height of the mountain when at a horizontal distance of $x$ kilometres from the starting point.

**[1 mark]**

**8** Given $f(x) = (5 + 2\sqrt{x})^3$, find $f'(x)$.

**[4 marks]**

**9** Find the coordinates of the points on the curve $y = 3x^3 + \dfrac{4}{x}$ where the gradient is equal to –35.

**[5 marks]**

## Section A: The basics

**1 (a)** Find the gradient of the curve $y = \sqrt{x} + \frac{1}{18}x^3$ at the point where $x = 9$.

**[3 marks]**

**1 (b)** Hence find an equation for the normal to the curve at the point $\left(9, \frac{87}{2}\right)$.

**[2 marks]**

**2 (a)** Given $y = 12x^2 - \frac{3}{x} + \frac{4}{5}$, find an expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$.

**[2 marks]**

**2 (b)** Hence find the $x$-coordinate of the stationary point.

**[2 marks]**

**2 (c)** Find an expression for $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ and hence determine the nature of the stationary point.

**[2 marks]**

**3 (a)** Given $\mathrm{f}(x) = 2x^3 + 2x^2 - 42x + 15$ , show that the values of $x$ for which $\mathrm{f}(x)$ is decreasing satisfy the inequality $3x^2 + 2x - 21 < 0$.

**[2 marks]**

**3 (b)** Hence find the values of $x$ for which $\mathrm{f}(x)$ is decreasing.

**[2 marks]**

## Section B: A bit more thinking

**4 (a)** The average cost, £$P$, of purchasing a return flight from Manchester to Greece $t$ months after 1st January can be modelled by the equation:

$$P = 0.67t^3 - 13.32t^2 + 70t + 207$$

Use calculus to find the value of $t$ at which the minimum average cost occurs and justify that it is a minimum.

**[4 marks]**

**4 (b)** Explain whether the value of $t$ found in part **(a)** is realistic.

**[1 mark]**

**5** The function $\mathrm{f}(x) = \dfrac{8}{x^4} + x - 7$ has positive roots at the points *A* and *B*.

Find the $x$-coordinate of the point on the curve where the gradient is parallel to *AB*.

**[3 marks]**

**6** The line $y = -\dfrac{1}{5}x$ is a normal to the curve $y = x\sqrt{x} - x + c$ . Find the value of $c$.

**[5 marks]**

**7** Prove that the function $\mathrm{f}(x) = x^{\frac{5}{3}} - kx^{\frac{4}{3}} + k^2x$ is increasing for all non-zero values of the real constant $k$.

**[4 marks]**

Integration

## Section A: The basics

**1 (a)** A curve has gradient function given by $\frac{dy}{dx} = 3x^4 - 5x + 2$

Find the general equation for this curve, giving your answer in the form $y = f(x)$.

**[2 marks]**

**1 (b)** Given further that the curve passes through the point (2, 12), find the equation for the curve, giving your answer in the form $y = f(x)$.

**[2 marks]**

**2 (a)** Express $\frac{2x - 7x^2}{x^5}$ in the form $2x^p - 7x^q$

**[1 mark]**

**2 (b)** Hence find $\int \frac{2x - 7x^2}{x^5} \, dx$

**[2 marks]**

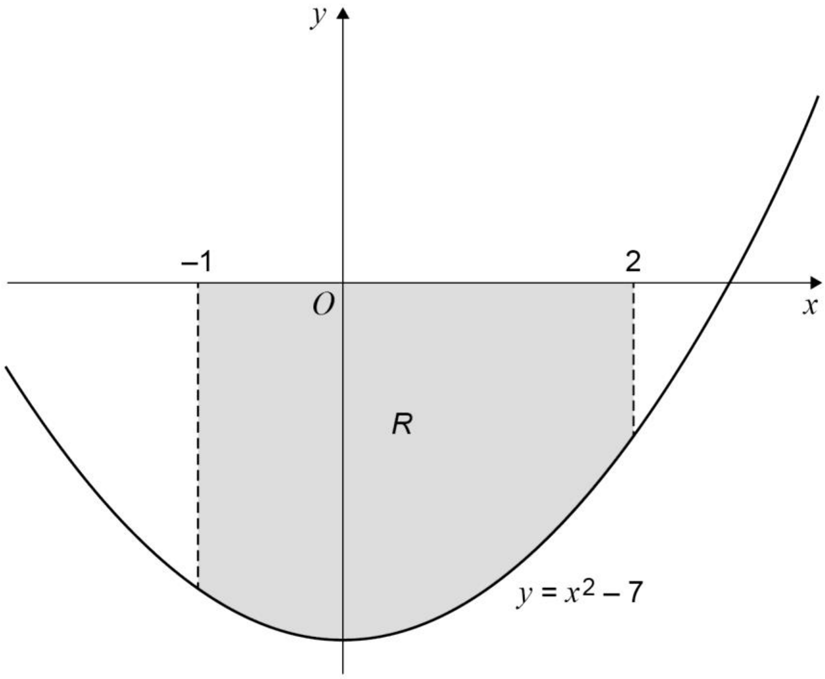
**3** Evaluate $\int_1^4 6x^2 - \sqrt{x} \, dx$. You must show your working.

**[4 marks]**

**4** The diagram shows a shaded region *R* bounded by the curve $y = x^2 - 7$, the *x*-axis and the lines $x = -1$ and $x = 2$.

Find the area of *R*.

Fully justify your answer.



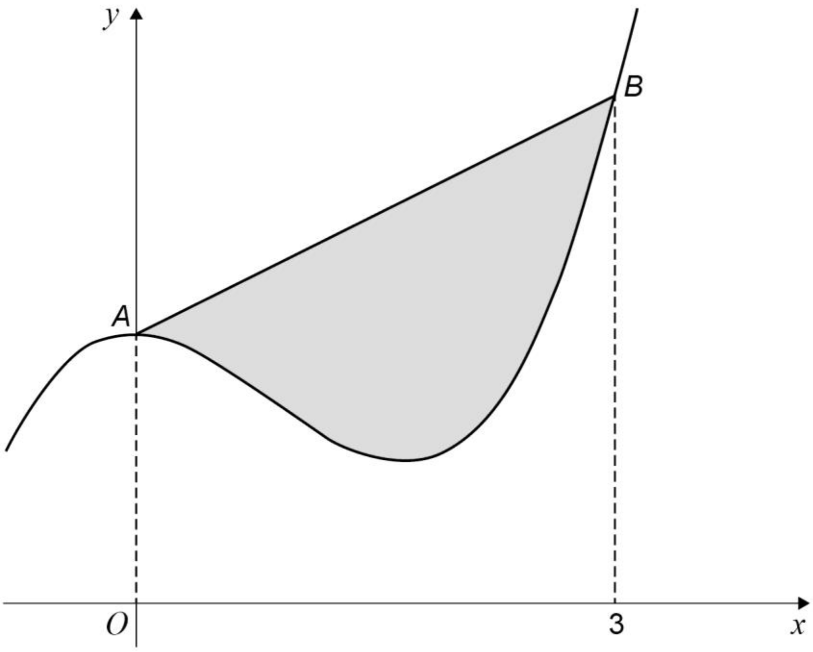

**[4 marks]**

**Section B: A bit more thinking**

**5** The diagram shows the graph of the curve
$y = 2x^3 - 4x^2 + 5$

The curve intersects the $y$-axis at the point $A$.

The point $B$ lies on the curve when $x = 3$




Find the area of the shaded region bounded by the curve and the line segment $AB$.

Fully justify your answer.

**[5 marks]**

**6 (a)** The curve $y = \mathrm{f}(x)$ has a gradient function

$$\mathrm{f}'(x) = \frac{2}{\sqrt{x}} - p\sqrt{x}$$

$A$ is the point on the curve where $x = \frac{1}{4}$

The equation of the tangent to the curve at $A$ is $y = \frac{5}{2}x + \frac{7}{8}$

Show that $p = 3$.
Fully justify your answer

**[2 marks]**

**6 (b)** Find the equation of the curve, giving your answer in the form $y = \mathrm{f}(x)$

**[4 marks]**

**7** $$\mathrm{f}(x) = \frac{8+3x}{x^3}$$

Find the value of the positive constant $k$ such that $\int_1^k \mathrm{f}(x)\,\mathrm{d}x = 6$ .

Fully justify your answer.

**[6 marks]**

Trigonometry 1

## Section A: The basics

**1 (a)** Circle the function that has a vertical line of symmetry at $y = 450^\circ$.

$y = \sin x$    $y = \cos x$    $y = \tan x$

**[1 mark]**

**1 (b)** Describe the symmetry and periodicity of the graph $= \tan x$.

**[2 marks]**

**2** Given that $\cos\theta = \frac{3}{5}$ and that $\theta$ is acute, find the exact values of $\sin \theta$ and $\tan \theta$.

**[2 marks]**

**3 (a)** Sketch the graph of $y = \cos x$ for $-180^\circ \leq x \leq 180^\circ$.

**[2 marks]**

**3 (b)** Solve the equation $\cos x = -\frac{3}{4}$, giving all the answers between $0^\circ \leq x \leq 360^\circ$ correct to three significant figures.

**[2 marks]**

**4 (a)** The triangle *ABC*, is such that *AB* = 3 cm, *BC* = 5 cm and *AC* = 7 cm.

The angle *ABC* is $\theta$.

Find the value of $\theta$.

**[3 marks]**

**4 (b)** Hence find the area of the triangle *ABC.* Give your answer in exact form.

**[3 marks]**

**5** Given that $\sin x = 0.8$ find the values of $\sin(180^\circ - x)$ and $\sin(180^\circ + x)$.

**[2 marks]**

## Section B: A bit more thinking

**6** A ship sails 5 km from *S* to *T* on a bearing of 062º and then 8 km from *T* to *U* on a bearing of 150º.

Calculate the distance *SU* giving your answer correct to two significant figures.

**[3 marks]**

**7 (a)** Three points of an equilateral triangle lie on a circumference of length $10\pi$.

Show that the area of the triangle is given by $\frac{75\sqrt{3}}{4}$ cm$^2$.

**[5 marks]**

**7 (b)** Calculate the perimeter of the triangle, leave your answer in surd form.

**[3 marks]**

**8 (a)** Consider a triangle *ABC* such that $\angle BAC$ is equal to 30º, $AB = x$, $BC = 4$ and $AC = 5$.

Show with your reasoning why $x^2 - 5\sqrt{3}x + 9 = 0$.

**[2 marks]**

**8 (b)** Show that there are **two** solutions to the equation $x^2 - 5\sqrt{3x} + 9 = 0$ and interpret it in this context.

**[2 marks]**

## Section A: The basics

**1** Simplify $\frac{\cos^2\theta}{1-\sin\,\theta}$

Circle your answer.

$1 - \sin\theta$ $1 + \cos\theta$ $1 + \sin\theta$ $1 - \cos\theta$

**[1 mark]**

**2** Show that $(\sin\theta + \cos\theta)^2 + (\sin\theta - \cos\theta)^2 \equiv 2$

**[3 marks]**

**3** Solve $\sin x = -\cos x$ for $0° \leq x \leq 180°$

**[2 marks]**

**4** Solve $\cos(\frac{x}{2} + 115°) = -0.5$ for $0° \leq x \leq 360°$

**[3 marks]**

**5 (a)** Show that $\frac{\sin^2\theta}{1+\cos\theta} = 1-\cos\theta$

**[2 marks]**

**5 (b)** Hence solve $\frac{\sin^2\theta}{1+\cos\theta} + 3\cos^2\theta = 3$ for $0° \leq \theta \leq 360°$, giving your answers to the nearest 0.1°.

**[5 marks]**

## Section B: A bit more thinking

**6** Solve $5 \sin x = 4 \cos x$ for $0° \leq x \leq 360°$, giving your answers to the nearest 0.1º.

**[3 marks]**

**7** Solve $\sin(2x - 60°) = 0.5$ for $0° \leq x \leq 360°$

**[4 marks]**

**8 (a)** Solve the simultaneous equations $k \sin x = 3$, $k \cos x = 7$ for $0° \leq x \leq 360°$, giving your answers to the nearest 0.1º.

**[3 marks]**

**8 (b)** State the coordinates of the maximum and minimum values of $\mathrm{f}(x) = k \sin x$ for $0° \leq x \leq 360°$.

**[2 marks]**

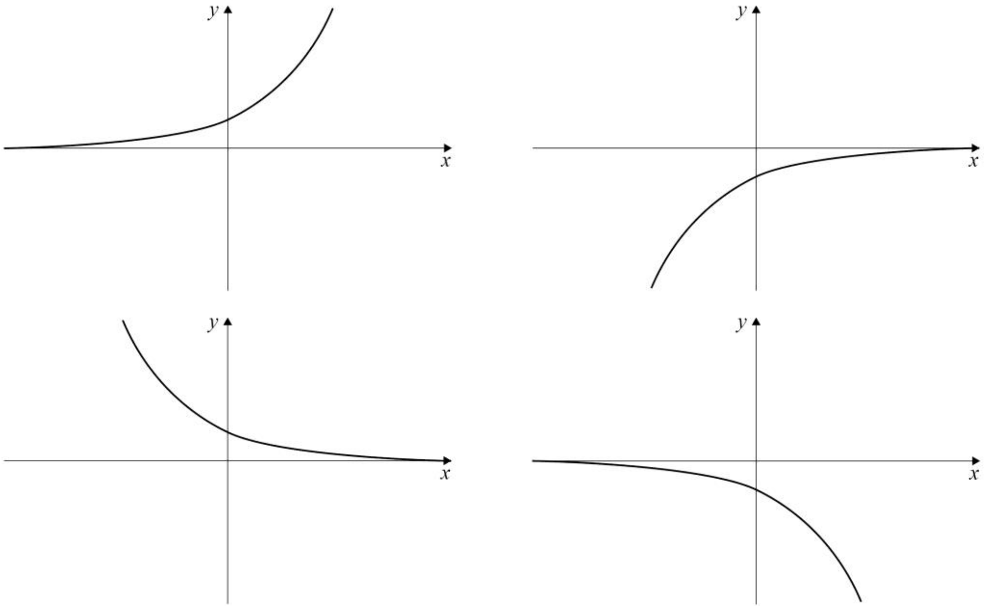
**9** Prove that $\dfrac{\tan\theta \sin\theta}{1+\cos\theta} \equiv \dfrac{1}{\cos\theta} - 1$

**[4 marks]**

Exponentials 1

## Section A: The basics

**1** **(a)** Circle the correct graph for the function $y = a^{(x+3)}$ where $a$ is a constant such that $a > 1$.



**[1 mark]**

**1** **(b)** Sketch the graph $y = -b^x$ where $b$ is a constant such that $0 < b < 1$.

State the coordinates of any intersections with the axes.

**[2 marks]**

**2** Express $3 \log x + 0.5 \log y - 2 \log z$ as a single logarithm.

**[3 marks]**

**3** Simplify $\ln e^x - 2\ln e^{-x} + 0.5\ln e^{2x}$

**[2 marks]**

**4** Sketch the graph $y = \ln(ax)$ where $a$ is a positive constant.

State the coordinates of any intersections with the axes.

**[2 marks]**

**5** Express $\log \sqrt[3]{\dfrac{a^6}{b^3 c}}$ in terms of $\log a$, $\log b$ and $\log c$.

**[3 marks]**

6 Express $\log_b 15 - 3 \log_b 3 - 2$ as a single logarithm.

**[3 marks]**

## Section B: A bit more thinking

**7** Given that $\log_{10} x = 550$, find the value of $\log_{10} \dfrac{1000}{\sqrt{x}}$

**[3 marks]**

**8** The tangent to the graph $y = e^{kx}$ at $x = 3$ has the equation $e^{b}y + 4x = 13$.

Find the values of $k$ and $b$.

**[4 marks]**

**9** Solve $\ln x = \ln (x + 6) - \ln (x + 2)$.

**[5 marks]**

**10** Find the exact coordinates of the intersection of the line $y = 4x + 7$ and the normal to the curve $y = e^{3x}$ at $x = 0$.

**[4 marks]**

## Section A: The basics

**1** Solve $4^{2x+5} = 6$

Circle your answer.

$x = \frac{1}{2}\log\frac{6}{4} - 5$ $\quad$ $x = \frac{1}{2}(\log 6 - 5\log 4)$ $\quad$ $x = \frac{1}{2}\left(\log\frac{6}{4} - 5\right)$ $\quad$ $x = \frac{1}{2}\left(\frac{\log 6}{\log 4} - 5\right)$

**[1 mark]**

**2** Solve $3^{x+2} = 0.4$ giving your answer to 3 significant figures.

**[3 marks]**

**3 (a)** The temperature $T$ °C of a liquid at time $t$ minutes is given by the equation

$T = 50 + 35e^{-0.8t}$ for $t \geq 0$

State the initial temperature of the liquid.

**[1 mark]**

**3 (b)** Calculate the rate of change of the temperature when $t = 2$ minutes.

**[2 marks]**

**3 (c)** Calculate to the nearest second the length of time for the temperature to decrease to 60°C.

**[3 marks]**

**3 (d)** The model represents a cup of tea cooling to room temperature.

Explain why the prediction made by the model for large values of $t$ may be inappropriate.

**[2 marks]**

**4 (a)** The table shows experimental values of $x$ and $y$.

| | | | | |
|---|---|---|---|---|
| $x$ | 1 | 3 | 5 | 7 |
| $y$ | 17.7 | 4.43 | 1.11 | 0.277 |

By plotting a suitable straight line graph, show that $x$ and $y$ are related by the equation $y = kb^x$ where $k$ and $b$ are constants to be found.

**[3 marks]**

**4 (b)** Hence find $y$ when $x = 4$

**[1 mark]**

## Section B: A bit more thinking

**5** Two years ago £200 was deposited in a bank account accruing compound interest. This has now increased to £240.

Assuming no more money (other than interest) is added to or taken from the account, how much money will the account contain after a further 10 years?

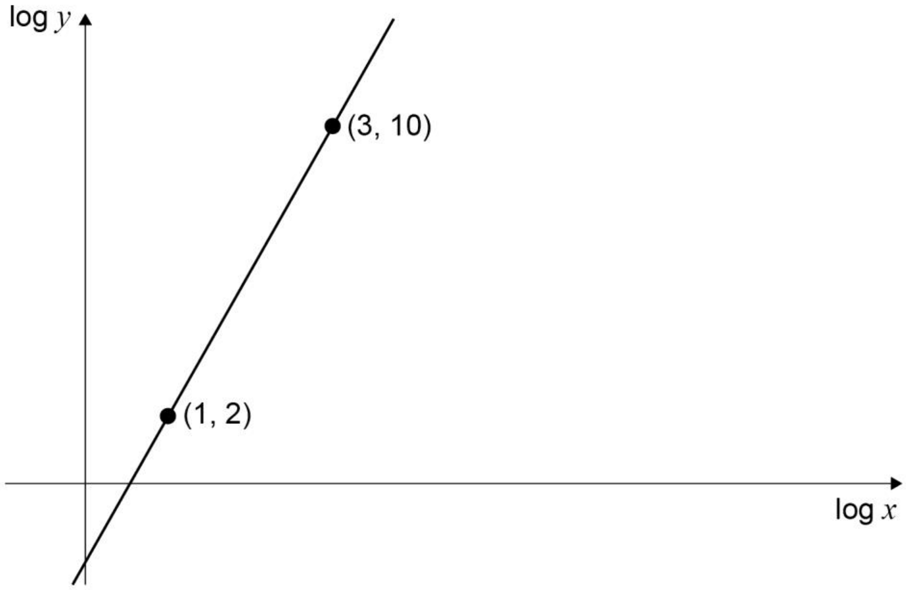
**[5 marks]**

**6** The concentration of a particular drug in a patient's body decays exponentially. The initial dose given is 1.75 mg/ml and after five hours the concentration has dropped to 1.2 mg/ml.

Find to the nearest minute how much longer it will take for the concentration to drop to 0.8 mg/ml.

**[6 marks]**

**7**




Using the graph, express $y$ in terms of $x$.

Hence find $y$ when $x = 10$.

**[5 marks]**