BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 11B

Skills 1

Sketch the graph of each of the following. In each case, write down the coordinates of any points at which the graph meets the coordinate axes.

(a) $y = |x - 1|$

(b) $y = |2x + 3|$

(c) $y = |4x - 7|$

(d) $y = \left|\frac{1}{2}x - 5\right|$

(e) $y = |7 - x|$

(f) $y = |6 - 4x|$

(g) $y = -|x|$

(h) $y = -|3x - 1|$

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Skills 2

Evaluate the exact value of the following integrals:

(a) $\int_0^{\sqrt{2}} 2x - 1 \, dx$

(b) $\int_1^2 \sqrt{x} - 2 \, dx$

(c) $\int_1^{\sqrt{3}} \frac{x^2 - 2}{4x^2} dx$

TAP FOR ANSWERS

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Skills 1 - Answers

USE DESMOS TO CHECK

TAP TO RETURN

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Skills 2 – Answers

(a) $2 - \sqrt{2}$

(b) $\frac{4\sqrt{2}-8}{3}$

(c) $\frac{3-\sqrt{3}}{12}$

TAP TO RETURN

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1

(a) By calculating the discriminant of $x^2 + 4x + 8 = 0$ explain why $x^2 + 4x + 8$ is always positive.

(b) By completing the square, explain why $x^2 + 4x + 8$ is always positive.

TAP FOR ANSWERS

2

(a) Sketch the graph of $y = x^3 - 6x^2 + 9x$

(b) The point with coordinates (-1,0) lies on the curve with equation $y = (x + a)^3 - 6(x + a)^2 + 9(x + a)$ where a is a constant. Find the two possible values of a

TAP FOR ANSWERS

3

Sketch the graph of $y = |x - 2a|$ (where a is a positive constant) showing the points of the intersection with coordinate axes. Solve $|x - 2a| = \frac{1}{3}x$ for x in terms of a.

TAP FOR ANSWERS

4

A, *B* and *C* are three points on a straight road such that *AB* = 80 m and *BC* = 60 m. A car travelling with uniform acceleration takes 4 seconds to travel between *A* & *B*, and 2 seconds to travel between *B* & *C*. Modelling the car as a particle, find its acceleration and its velocity at *A*.

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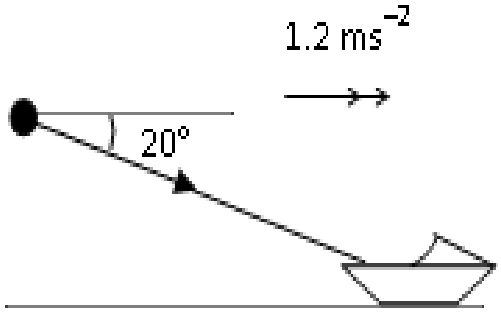
5

A paraglider of mass 90kg is pulled by a rope attached to a speedboat. With the rope making an angle of 20^o to the horizontal the paraglider is moving in a straight line parallel to the surface of the water with an acceleration of $1.2ms^{-2}$. The tension in the rope is 250N. By drawing a force diagram and resolving forces horizontally and vertically calculate the magnitude of the vertical force acting on the person, and the magnitude of the air resistance (R). Let (L) be the lift generated by the wings.



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A particle is projected from a point with speed 21 m s^{-1} at an angle of elevation α and moves freely under gravity. When the particle has moved a horizontal distance x m, its height above the point of projection is y m.

(a) Show that $y = x \tan \alpha - \frac{x^2}{90 \cos^2 \alpha}$

(b) Given that $y = 8.1$ when $x = 36$, find the value of $\tan \alpha$

TAP FOR ANSWERS

7

Two ships P and Q are moving with constant velocities. Ship P moves with velocity $(2\mathbf{i} - 3\mathbf{j})$ km h^{-1} and ship Q moves with velocity $(3\mathbf{i} + 4\mathbf{j})$ km h^{-1}.

(a) Find, to the nearest degree, the bearing on which Q is moving.

At 2 p.m., ship P is at the point with position vector $(\mathbf{i} + \mathbf{j})$ km and ship Q is at the point with position vector $(-2\mathbf{j})$ km.

At time t hours after 2 p.m., the position vector of P is $\mathbf{p}$ km and the position vector of Q is $\mathbf{q}$ km.

(b) Write down expressions, in terms of t, for

(i) $\mathbf{p}$,

(ii) $\mathbf{q}$,

(iii) $\overrightarrow{PQ}$

(c) Find the time when

(i) Q is due north of P,

(ii) Q is north-west of P.

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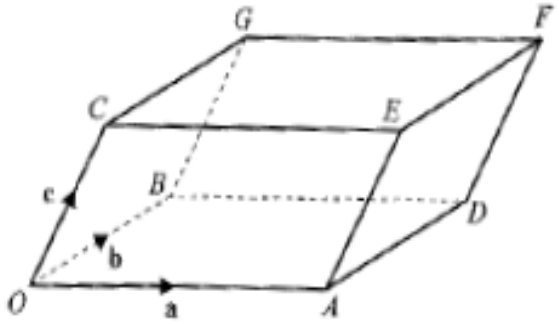
8



A parallelepiped is a three-dimensional figure formed by six parallelograms. The diagram shows a parallelepiped with vertices *o, A, B, C, D, E, F* and *G*.

a, **b** and **c** are the vectors $\overrightarrow{OA}, \overrightarrow{OB}$ and $\overrightarrow{OC}$ respectively. Prove that the diagonals *OF* and *AG* bisect each other.

TAP FOR ANSWERS

9

NEW TECHS!

$f(x) = \sin x$

Use differentiation from first principles to prove that $f'(x) = \cos x$

(HINT: Use the compound angle formula $\sin(A+B) = \sin A \cos B + \cos A \sin B$)

TAP FOR ANSWERS

10

NEW TECHS!

$f(x) = 6x^2(x^3 - 7)$

(a) Multiply out the expression and differentiate to find an expression for f'(x)

(b) Now consider the functions $g(x) = 6x^2$ *and* $h(x) = x^3 - 7$. Find expressions for g'(x) and h'(x)

(c) Now, f(x) = g(x) h(x).
Which one of the following rules is true?

A f'(x) = g'(x) h'(x)
B f'(x) = g'(x) h'(x) + g(x) h(x)
C f'(x) = g(x) h'(x) + g'(x) h(x)
D f'(x) = g'(x) h(x) + g(x) h'(x)

TAP FOR ANSWERS

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Given that $y^{\frac{1}{2}} = x^{\frac{1}{3}} + 3$:

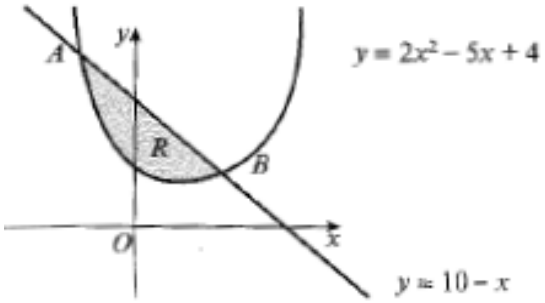
(a) show that $y = x^{\frac{2}{3}} + Ax^{\frac{1}{3}} + B$, where A and B are constants to be found.

(b) Hence find $\int y \, dx$

TAP FOR ANSWERS

BHASVIC MαTHS
A1 DOUBLES ASSIGNMENT 11B

12



The line with equation $y = 10 - x$ cuts the curve with equation $y = 2x^2 - 5x + 4$ at the points *A* and *B*, as shown.

(a) find the coordinates of *A* and the coordinates of *B*.

The shaded region *R* is bounded by the line and the curve as shown.

(b) Find the exact area of *R*.

TAP FOR ANSWERS

1 - Answers

(a) $b^2 - 4ac = 16 < 0$ so the graph of $y = x^2 + 4x + 8$ does not cut the x axis and therefore $x^2 + 4x + 8$ is always positive.

(b) $x^2 + 4x + 8 = (x + 2)^2 + 4$
$(x + 2)^2$ is always positive for all values of x.
$(x + 2)^2 + 4 \geq 0$ so $x^2 + 4x + 8$ is always positive.

TAP TO RETURN

2 - Answers

(a) Check on DESMOS

(b) $a = 1 \; or \; -2$

TAP TO RETURN

3 - Answers

$x = 3a$ or $\frac{3}{2}a$

TAP TO RETURN

4 - Answers

$a = 10/3 \text{ ms}^{-2}$ $v = 40/3 \text{ ms}^{-1}$

TAP TO RETURN

5 - Answers

L=968N, R=127N

TAP TO RETURN

6 - Answers

$\tan\alpha = \frac{5}{4}$

TAP TO RETURN

7 - Answers

(a) 37°

(b) (i) $\mathbf{p} = (\mathbf{i} + \mathbf{j}) + t(2\mathbf{i} - 3\mathbf{j})$
(ii) $\mathbf{q} = (-2\mathbf{j}) + t(3\mathbf{i} + 4\mathbf{j})$
(iii) $\mathbf{PQ} = \mathbf{q} - \mathbf{p} = (-\mathbf{i} - 3\mathbf{j}) + t(\mathbf{i} + 7\mathbf{j})$

(c) (i) 3pm (ii) 2.30pm

TAP TO RETURN

8 - Answers

Let H = point of intersection of OF and AG.

$\overrightarrow{OH} = r\overrightarrow{OA} + s\overrightarrow{AG}$

$\overrightarrow{OF} = \mathbf{a} + \mathbf{b} + \mathbf{c}, \overrightarrow{AG} = -\mathbf{a} + \mathbf{b} + \mathbf{c}$

So $r(\mathbf{a} + \mathbf{b} + \mathbf{c}) = \mathbf{a} + s(-\mathbf{a} + \mathbf{b} + \mathbf{c})$

$r = 1 - s = s \Rightarrow r = s = \frac{1}{2}$, so $\overrightarrow{OH} = \frac{1}{2}\overrightarrow{OF}$ and $\overrightarrow{AH} = \frac{1}{2}\overrightarrow{AG}$

TAP TO RETURN

9 - Answers

Proof

TAP TO RETURN

10 - Answers

(a) $30x^4 - 84x$

(b) 12x, $3x^2$

(c) C and D are both true

TAP TO RETURN

11 - Answers

(a) $A = 6, B = 9$

(b) $\frac{3}{5}x^{\frac{5}{3}} + \frac{9}{2}x^{\frac{4}{3}} + 9x + c$

TAP TO RETURN

12 - Answers

(a) (-1, 11) and (3, 7)

(b) $21\frac{1}{3}$

TAP TO RETURN