

A2 Maths with Mechanics Test (rho) Version O

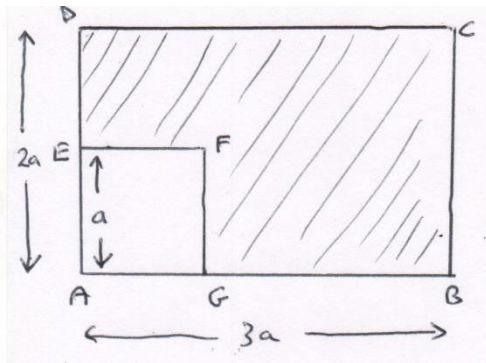
1 Evaluate $\int_1^{\ln 3} e^{3x} dx$, giving an EXACT answer

2 Evaluate $\int_4^6 \frac{1}{x^2-4} dx$, giving an EXACT answer

3 Sketch $y = 1 - e^{-x}$ Show all asymptotes and intercepts with the axes

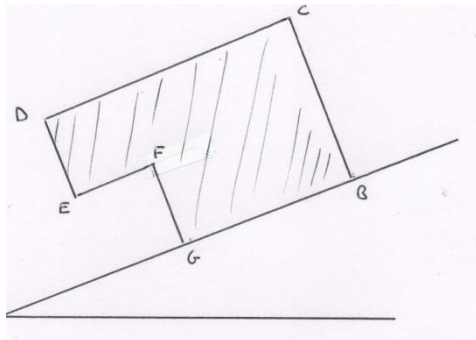
4 $\int x \sin x dx$

5 A uniform lamina consists of a rectangle ABCD, where $AB = 3a$ and $AD = 2a$, with a square hole EFGA, where $EF = a$, as shown in the diagram:



a) Find the distance of the centre of mass of the lamina from i) AD, ii) AB

The lamina is balanced on a rough plane inclined to the horizontal at an angle θ . The plane of the lamina is vertical and the inclined plane is sufficiently rough to prevent the lamina from slipping. The side GB is in contact with the plane G lower than B, as shown in the diagram:



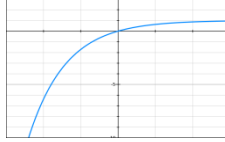
b) Find in degrees, to one decimal place, the greatest value of θ for which the lamina can rest in equilibrium without slipping.

Answers Version O

1) $9 - \frac{e^3}{3}$

2) $\frac{1}{4} \ln \frac{3}{2}$

- 3) Intercept (0,0)
Asymptote $y=1$



4) $-x \cos x + \sin x + c$

5) a) i) $\frac{17a}{10} = 1.7a$

ii) $\frac{11a}{10} = 1.1a$

b) $32.5^\circ (= 90 - \tan^{-1} \frac{11}{7})$

A2 Maths with Mechanics Test (rho)Version P

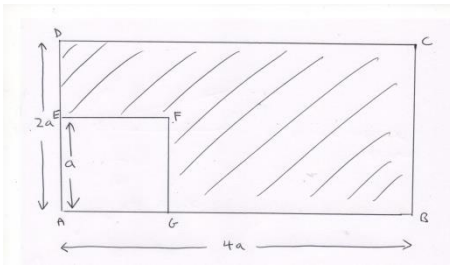
1 Evaluate $\int_1^{\ln 4} e^{4x} dx$, giving an EXACT answer

2 Evaluate $\int_4^6 \frac{1}{x^2-9} dx$, giving an EXACT answer

3 Sketch $y = 2 - e^{-x}$ Show all asymptotes and intercepts with the axes

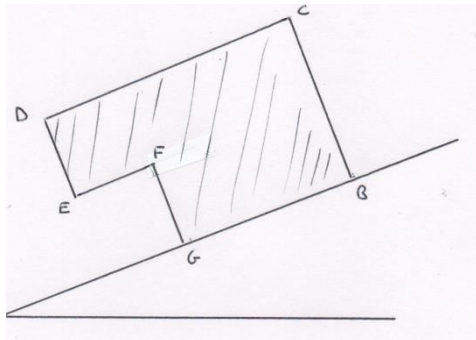
4 $\int x \cos x dx$

5 A uniform lamina consists of a rectangle ABCD, where $AB = 4a$ and $AD = 2a$, with a square hole EFGA, where $EF = a$, as shown in the diagram:



a) Find the distance of the centre of mass of the lamina from i) AD, ii) AB

The lamina is balanced on a rough plane inclined to the horizontal at an angle θ . The plane of the lamina is vertical and the inclined plane is sufficiently rough to prevent the lamina from slipping. The side GB is in contact with the plane G lower than B, as shown in the diagram:



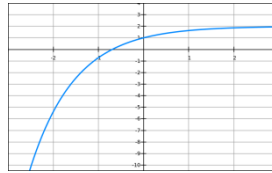
b) Find in degrees, to one decimal place, the greatest value of θ for which the lamina can rest in equilibrium without slipping.

Answers Version P

1) $64 - \frac{e^4}{4}$

2) $\frac{1}{6} \ln \frac{7}{3}$

- 3) Intercepts (0,1) and (-ln2,0)
Asymptote $y=2$



4) $x \sin x + \cos x + c$

5) a) i) $\frac{31a}{14} = 2.2a$

ii) $\frac{15a}{14} = 1.1a$

b) $48.6^\circ (= 90 - \tan^{-1} \frac{15}{17})$

A2 Maths with Mechanics Test (rho)Version Q

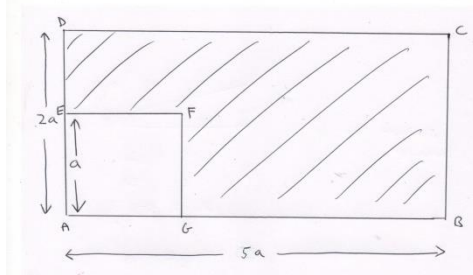
1 Evaluate $\int_1^{\ln 5} e^{5x} dx$, giving an EXACT answer

2 Evaluate $\int_5^6 \frac{1}{x^2-9} dx$, giving an EXACT answer

3 Sketch $y = 3 - e^{-x}$ Show all asymptotes and intercepts with the axes

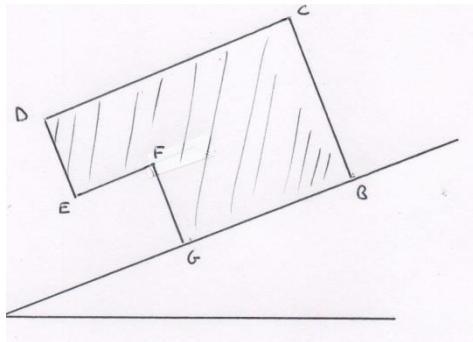
4 $\int \frac{1}{2} x \sin x dx$

5 A uniform lamina consists of a rectangle ABCD, where $AB = 5a$ and $AD = 2a$, with a square hole EFGA, where $EF = a$, as shown in the diagram:



a) Find the distance of the centre of mass of the lamina from i) AD, ii) AB

The lamina is balanced on a rough plane inclined to the horizontal at an angle θ . The plane of the lamina is vertical and the inclined plane is sufficiently rough to prevent the lamina from slipping. The side GB is in contact with the plane G lower than B, as shown in the diagram:



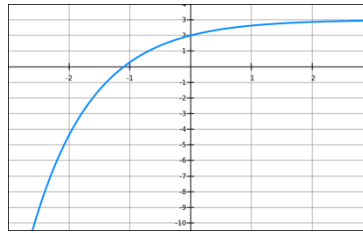
b) Find in degrees, to one decimal place, the greatest value of θ for which the lamina can rest in equilibrium without slipping.

Answers Version Q

1) $625 - \frac{e^5}{5}$

2) $\frac{1}{6} \ln \frac{4}{3}$

3) Intercepts (0,2) and (-ln3,0)
Asymptote $y=3$



4) $-\frac{x}{2} \cos x + \frac{1}{2} \sin x + c$

5) a) i) $\frac{49a}{18} = 2.7a$

ii) $\frac{19a}{18} = 1.1a$

b) $58.5^\circ (= 90 - \tan^{-1} \frac{19}{31})$

A2 Maths with Mechanics Test (rho)Version R

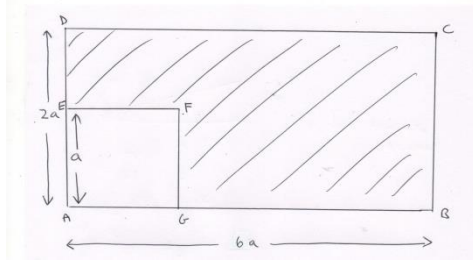
1 Evaluate $\int_1^{\ln 6} e^{6x} dx$, giving an EXACT answer

2 Evaluate $\int_5^6 \frac{1}{x^2-4} dx$, giving an EXACT answer

3 Sketch $y = 4 - e^{-x}$ Show all asymptotes and intercepts with the axes

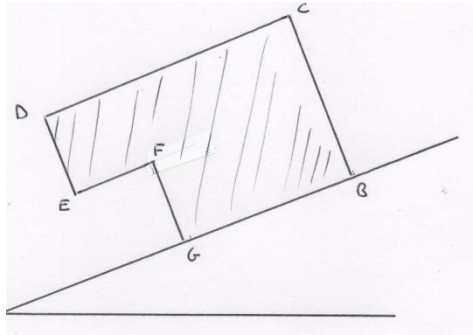
4 $\int x - x \sin x dx$

5 A uniform lamina consists of a rectangle ABCD, where $AB = 6a$ and $AD = 2a$, with a square hole EFGA, where $EF = a$, as shown in the diagram:



a) Find the distance of the centre of mass of the lamina from i) AD, ii) AB

The lamina is balanced on a rough plane inclined to the horizontal at an angle θ . The plane of the lamina is vertical and the inclined plane is sufficiently rough to prevent the lamina from slipping. The side GB is in contact with the plane G lower than B, as shown in the diagram:



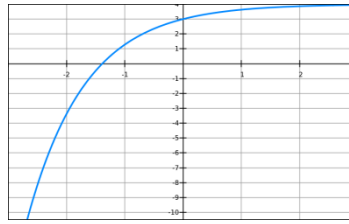
b) Find in degrees, to one decimal place, the greatest value of θ for which the lamina can rest in equilibrium without slipping.

Answers Version R

1) $7776 - \frac{e^6}{6}$

2) $\frac{1}{4} \ln \frac{7}{6}$

- 3) Intercepts (0,3) and (-ln4,0)
Asymptote $y=4$



4) $\frac{1}{2}x^2 + x \cos x - \sin x + c$

5) a) i) $\frac{71a}{22} = 3.2a$

ii) $\frac{23a}{22} = 1.0a$

b) $64.9^\circ (= 90 - \tan^{-1} \frac{23}{49})$