Name: _____ **Student ID:** _____

You have three (3) hours to complete the exam: 8:30am to 11:30am.

Nobody will be allowed to leave in the first half hour.

Write your answers in the spaces provided.

This is worth 40% of your final mark. The value of each question is indicated next to it.

No aids (books, notes, calculators, mobile phones, PDA's, other electronic devices, etc.) are permitted.

Check that you have all 9 pages.

Name: _____ **Student ID:** _____

1) How does the traditional animation principle of squash and stretch relate to motion blur? [1%]

2) How does the traditional animation principle of slow in/out (or ease in/out) reflect physics? [1%]

3) In the context of animation, what does layering mean? [1%]

4) How are Hermite splines and Catmull-Rom splines related? [1%]

5) How could you construct a C^2 interpolating spline with local control? (You don't need to provide formulas) [2%]

Name: _____ **Student ID:** _____

6) How many degrees of freedom does the root link of a 3D Forwards Kinematic skeleton normally have? [1%]

7) How many degrees of freedom does a bicycle have? (You may use as simple a model as you think reasonable; justify your answer with a sketch. Note that your answer should be greater than the answer above.) [2%]

8) Give an example of where Jacobian-based algorithms for IK would break down. [2%]

Name: _____ **Student ID:** _____

9) How could you formulate IK to avoid links penetrating other geometry in the scene? Give a simple algorithm (don't worry about robustness in special cases) for solving this IK problem. [2%]

10) What does "pre-multiplied alpha" refer to? [1%]

11) What is gamma correction, and should it be done before or after compositing? [1%]

12) What is a simple way to capture a real-world environment map? How do you avoid including the capturing apparatus in the map? [1%]

Name: _____ **Student ID:** _____

13) What are the four different images involved in differential rendering? How are they composited together? [2%]

14) What is match move? How does it relate to through-the-lens camera control? [2%]

15) What is the difference between first-order and second-order motion? [1%]

Name: _____ **Student ID:** _____

16) Write down Forward Euler, Symplectic Euler, and Backward Euler for the same second-order motion. How are they all different in terms of stability? [2%]

17) Assuming you have been given an appropriate kernel function $k(|\vec{x}|)$ already, write down the formula for a blobby implicit surface. How could you efficiently evaluate this for a large number of particles? [2%]

Name: _____ **Student ID:** _____

18) Given a signed distance function $\phi(\vec{x})$ for a surface (with $\phi > 0$ outside and $\phi < 0$ inside), write down a repulsion force field which is only active inside the object. [2%]

19) How should the Fourier coefficients of noise (in the computer graphics sense of the word) behave? [2%]

20) Write down the recommended algorithm (with all formulas) for resolving inelastic frictionless collisions between a particle and some immovable object (with zero velocity). [2%]

Name: _____ **Student ID:** _____

21) Why do you normally use quaternions to represent rigid body orientations? Why should you sometimes convert to an orthogonal matrix representation? [2%]

22) Give one problem that can occur in character skinning with linear blend SSD's, and two possible ways to fix it. [2%]

23) What is foot-skate? How can you fix it? [1%]

24) What is a motion graph? Why should it be strongly connected? [2%]

Name: _____ **Student ID:** _____

25) What is PD-control? How does it simplify making motion controllers? Explain how to construct a simple open loop walking controller with PD-control. [2%]